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INSTRUCTION BOOK
for
RADIO SET AN/VRC-2X

Manufactured By
Utility Electronics Corp.
Order No. 16816-P-51-01
4 April 1952

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WARNING

HIGH VOLTAGE
is used in the operation of
this equipment.

DEATH ON CONTACT
may result if operating personnel
fail to observe safety precautions.

First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only,* remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used, Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

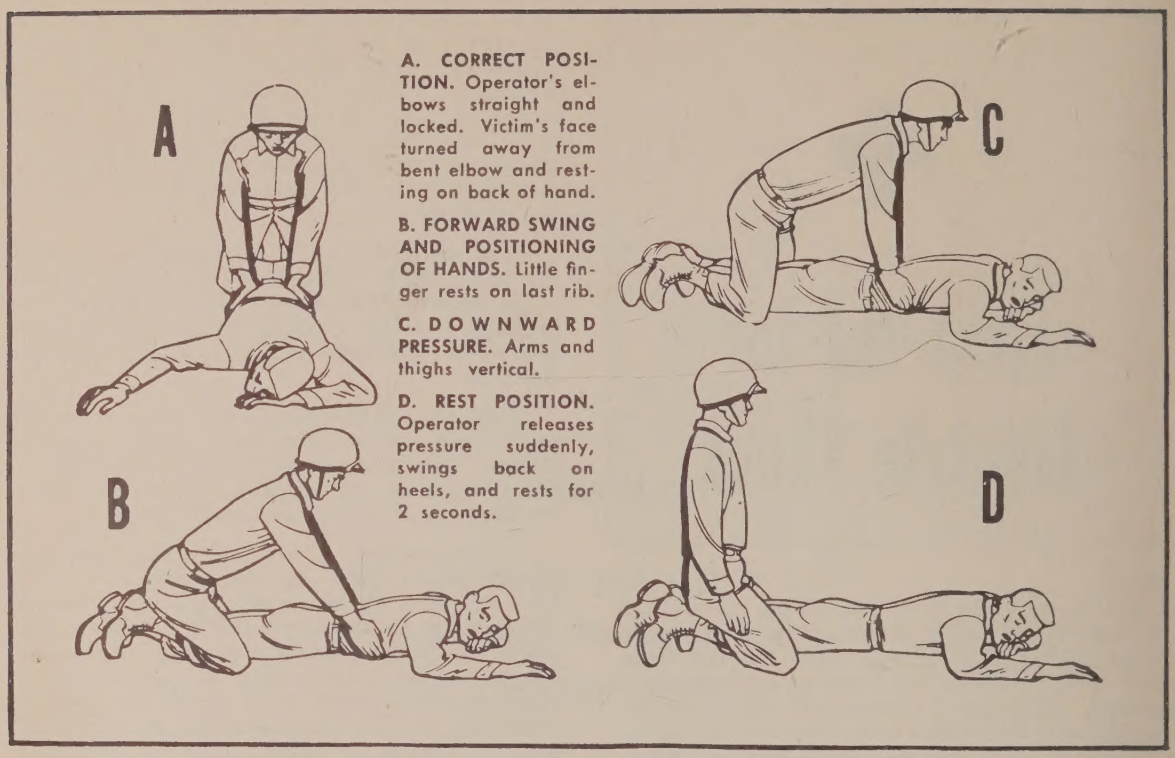
f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit up on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4



A. CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.

B. FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.

C. DOWNWARD PRESSURE. Arms and thighs vertical.

D. REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.

seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

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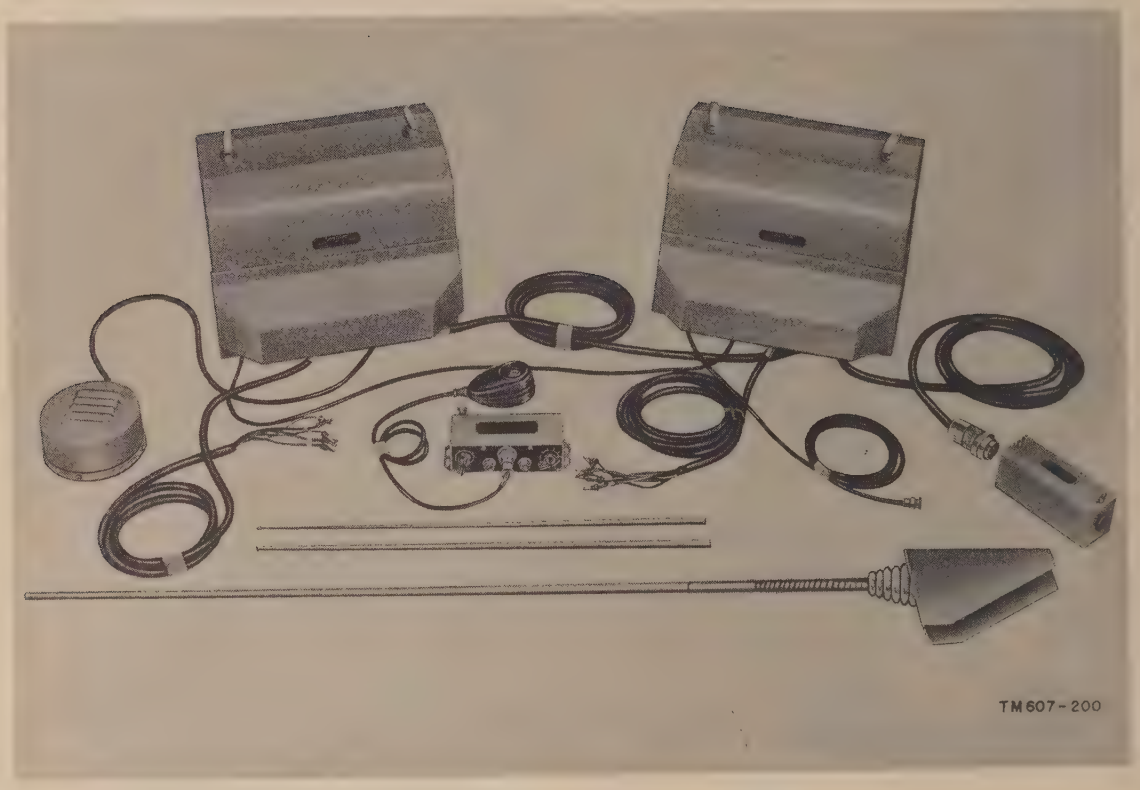


Figure 1 Radio Set AN/VRC-2X.

Note. This instruction book will be replaced by a revision of TM 11-607, which, when published, will be listed in SR 310-20-4

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This instruction book contains the necessary instructions for the installation, operation, maintenance, and repair of Radio Set AN/VRC-2X (fig. 1). In addition to these instructions there are two appendixes covering a list of references and an identification table of parts.

b. Radio Set AN/VRC-2X is very similar in structure, function, and mechanical layout to Radio Set AN/VRC-2 delivered on Orders No. 20591-PH-49 and 21756-PH-50. The equipments differ only in those components necessary for operation from primary power sources of different value.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army materiel and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army), NAV DEPT SERIAL 85P00 (Navy), and AFR 71-4 (Air Force).

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700-45-5.

c. USAF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700-45-5 and AFR 65-26.

d. DA AGO Form 11-238 (fig. 22), Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

e. DA AGO Form 11-239 (fig. 23), Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Rado Set AN/VRC-2X is a complete radio set, less primary power source, designed for vehicular operation. It provides two-way voice communication with similar fixed or mobile equipment operating at the same frequency (fig. 2). The set operates in the frequency range of 30 to 40 mc (megacycles), utilizing f-m (frequency-modulation).

b. The communication circuit is of the *single frequency* (receiver and transmitter tuned to same frequency), *push-to-talk* type (fig. 3). Operation of a push-to-talk button disables the receiver and turns on the transmitter. Conversation can proceed in only one direction at a time.

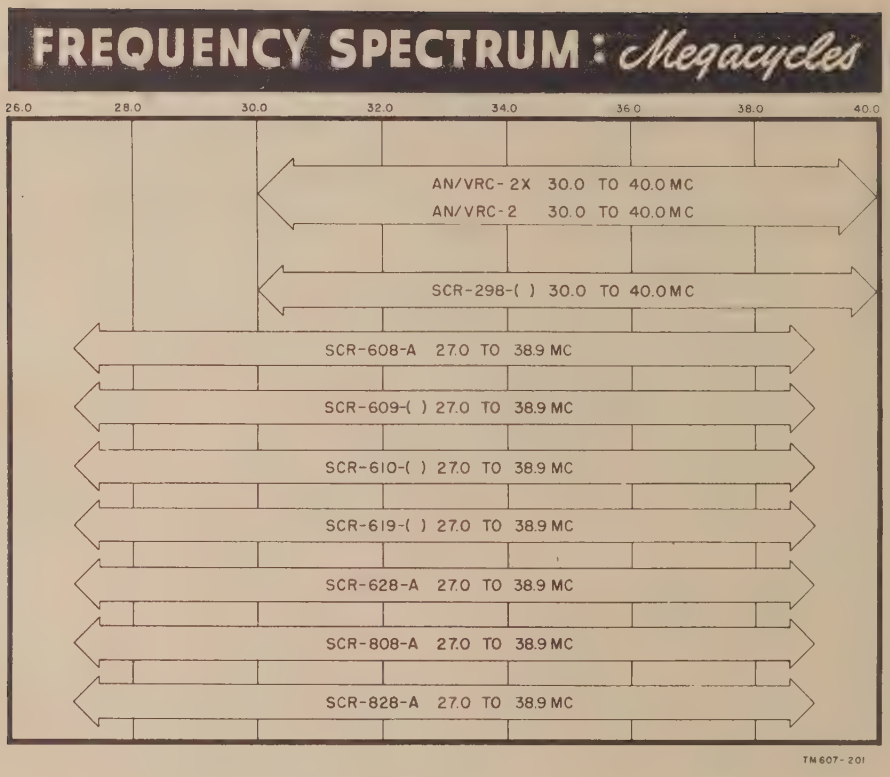


Figure 2. Frequency spectrum chart.

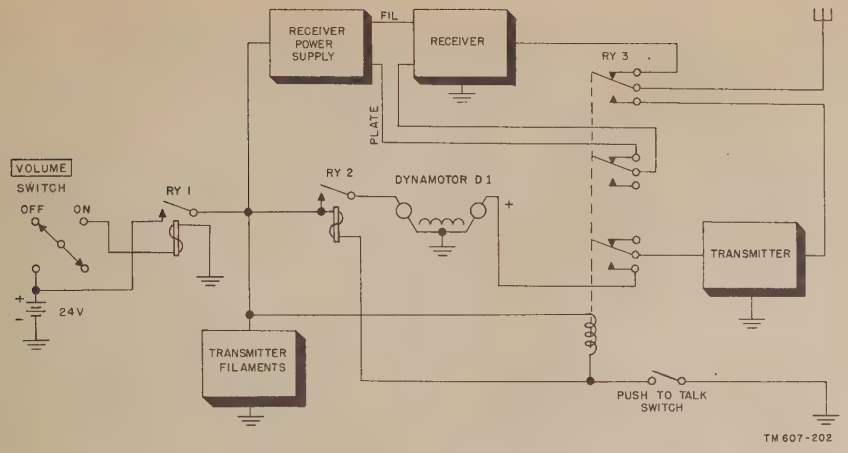


Figure 3. Radio Set AN/VRC-2X, over-all block diagram.

c. The equipment consists of the following: Radio Receiver R-435/VRC-2X, Radio Transmitter T-322/VRC-2X, Radio Set Control C-1060/VRC-2X and associated operating and installation components.

4. Technical Characteristics

a. Radio Receiver R-435/VRC-2X.

Power input.....24 volts at 3 amperes
Frequency range .....30 to 40 mc.
Receiver types .....Dual conversion superheterodyne with two crystal oscillator circuits.
Number of tubes.....13 in receiver, 2 in power supply.
Type of signal received.....F-m voice.
Antenna .....1/4 wave telescopic whip.

b. Radio Transmitter T-322/VRC-2X.

Power input.....24 volts at 10 amperes.
Power output .....30 watts.
Frequency range .....30 to 40 mc in 3 bands.
Transmitter type .....Crystal-controlled, f-m.
Type of modulation.....F-m resulting from phase modulation.
Frequency deviation .....±15 kc (kilocycles) for full modulation.
Number of tubes ..... 7.
Antenna .....Same as receiver.

Note. A frequency band is selected by installing the proper antenna loading coil in its socket on the transmitter chassis (fig. 58). Selection of the proper coil is explained in paragraph 39*c*.

5. Packaging Data

a. The entire Radio Set AN/VRC-2X is packed in one box which contains the transmitter, receiver, accessories, and antenna. It weighs 205 pounds and has a volume of 12.3 cubic feet.

b. Inner packaging of all parts is in waterproof, moisture-vaporproof sealed wrappers containing a dehydrating agent. The equipment is first wrapped in greaseproof paper wrapping. Moisture-vaporproof bags are placed over the cushioned parts and assemblies. Cartons containing material are inclosed in moisture-vaporproof bags and then these sealed packages are placed in tight-fitting outer unit containers.

Note. Items may be packaged in a different manner, depending on supply channel.

7. Description of Major Components

a. Radio Receiver R-435/VRC-2X (fig. 6). Radio Receiver R-435/VRC-2X is a 13-tube f-m receiver mounted on the same chassis with its vibrator power supply. All jacks and receptacles are mounted on the front panel. There are no tuning controls on the receiver chassis, since operation of the receiver is accomplished through the control head which is part of the equipment.

b. Radio Transmitter T-322/VRC-2X (fig. 7). Radio Transmitter T-322/VRC-2X is a 7-tube f-m transmitter and dynamotor power supply mounted on a single chassis. All connectors and jacks are mounted on the front panel of the transmitter. Operation of the transmitter is accomplished through the same control head used in the operation of Radio Receiver R-435/VRC-2X

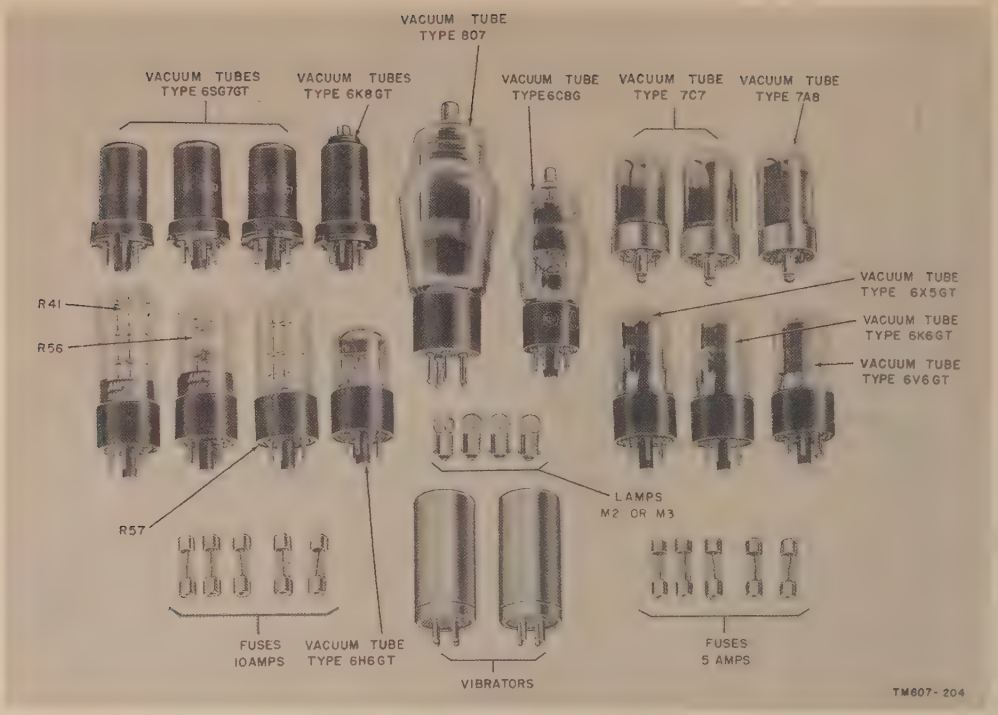


Figure 5. Radio Set AN/VRC-2X, spares supplied.

6. Table of Components (figs. 4 and 5)

Component	Required No.	Length (inches)	Width (inches)	Height (inches)	Volume (cu. ft.)	Weight (lb.)
Packing Box	1				12.3	205
Radio Transmitter T-322/VRC-2X	1	15	10	11½	1	41
Radio Set Control C-1060/VRC-2X	1	7¼	3¼	2¼	1/32	1½
Microphone M-38/U	1	3¾	3½	5	1/25	1.25
Cable group	1	11	11	5	⅓	13.
Transmitter plate coils (set of 3)	1	2¼	1½	4	1/100	1.
Installation components (Box)	1	4	3	4½	1/25	1.75
Radio Receiver R-435/VRC-2X	1	15	10	11½	1	35.
Speaker LS-158/U	1	dia. 9½	4¼		1/6	5.0
Fuse Box J-498/VRC-2X	1	6⅛	2-3/16	2½	1/50	.5
Switch Guards MX-1386/VRC-2X	2	14⅞	3¾	4¼	1/7	.5
Spare parts group	1	8	5	6	1/7	10.
Instruction book	2	8	10½	½	.03	.5
Antenna	1	78	1½	1½		3¼

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisition of spare parts.

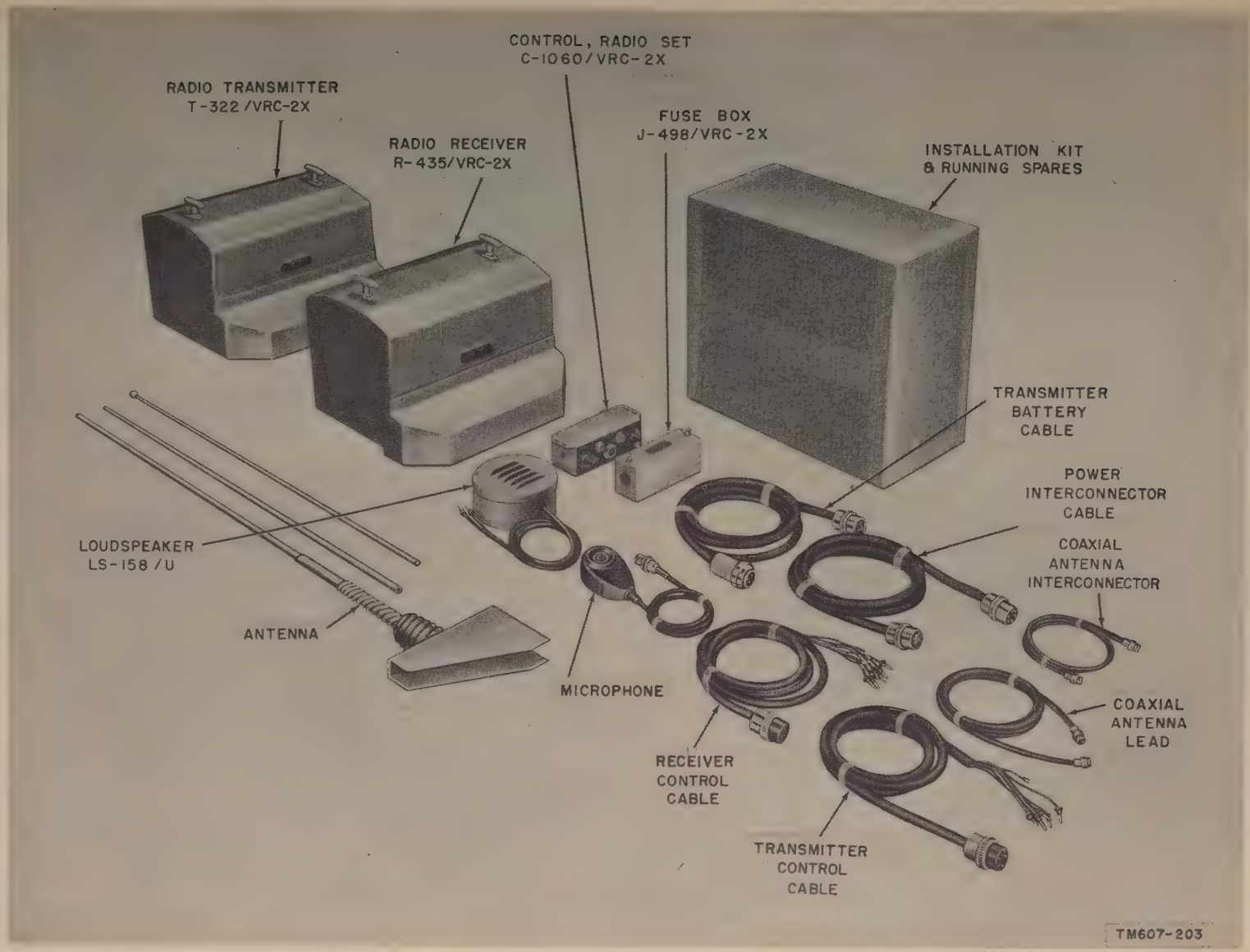


Figure 4. Radio Set AN/VRC-2X, components.

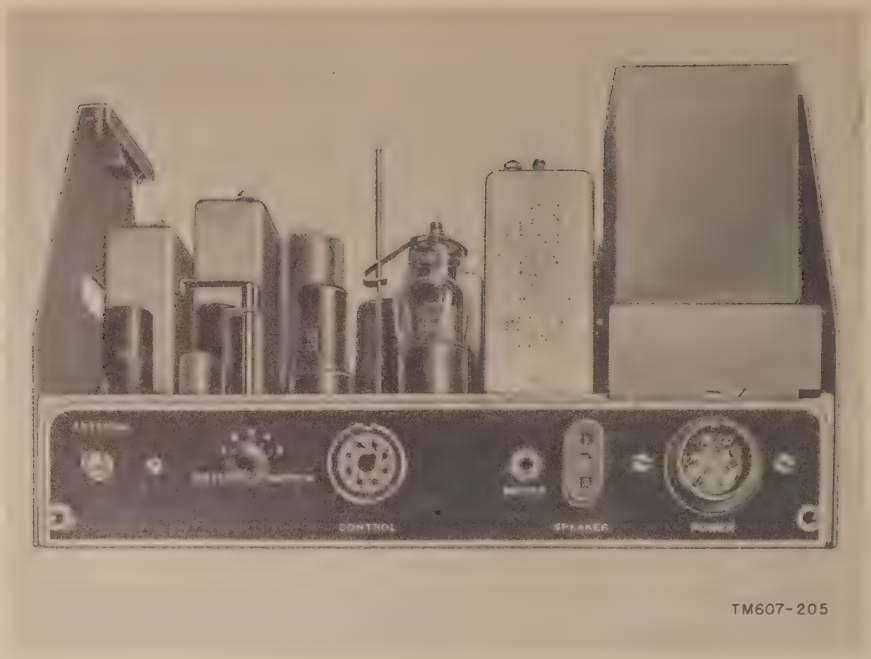


Figure 6. Radio Receiver R-435/VRC-2X, with cover and switch guard removed.

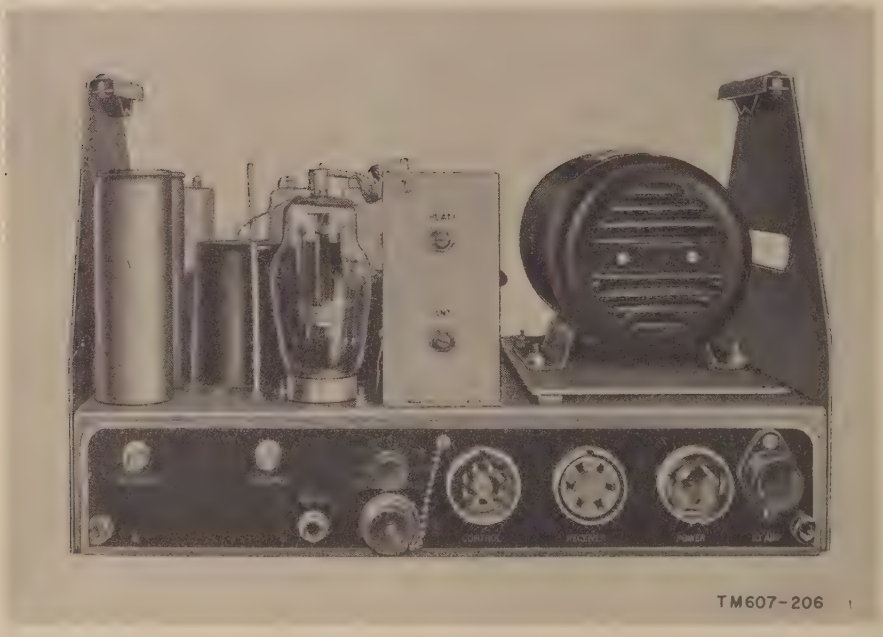


Figure 7. Radio Transmitter T-322/VRC-2X, with cover and switch guard removed.

c. Radio Set Control C-1060/VRC-2X (fig. 8). Radio Set Control C-1060/VRC-2X is a control head which contains all controls necessary for the normal operation of the receiver and transmitter. The control head also contains pilot lights which indicate the application of power to the receiver or transmitter.

d. Microphone M-38/U (fig. 9). The microphone is a carbon type with a push-to-talk button. It may be connected to the front panel of the transmitter or control head.

e. Speaker LS-158/U (fig. 10). Speaker LS-158/U is a 5-inch PM speaker with a 3-ohm voice coil. It is plugged into the receiver or into the control head.

f. Antenna AT-129/VR (fig. 11). Antenna AT-129/VR is an adjustable whip type antenna designed for vehicular mounting. It is adjusted to be approximately ¼ wavelength at the operating frequency of the equipment.

8. Description of Minor Components

a. Cable Group (fig. 12). Cables necessary for interconnecting the receiver, transmitter, and control head are supplied. In addition, a coaxial cable for connecting the antenna to the transmitter and a cable for connection to the 24-volt battery are provided.

b. Fuse Box J-498/VRC-2X (fig. 13). A fuse box is provided for mounting the fuse in the cable connecting the battery to the equipment. The fuse box is mounted on the vehicle wall.

c. Installation Components (fig. 14). Mounting plates and hardware are provided to effect proper installation of the equipment, thereby preventing needless break-downs. General installation instructions are given in paragraph 14.

9. Running Spares (fig. 5)

Running spares for Radio Set AN/VRC-2X are packed in a carton included in the packing. Following is a list of running spares:

Electron tube, type 6C8G.....1
Electron tube, type 6H6GT.....1
Electron tube, type 6K6GT.....1
Electron tube, type 6K8GT.....1
Electron tube, type 6SG7GT.....3
Electron tube, type 6X5GT.....1
Electron tube, type 807.....1
Electron tube, type 6C8G.....1
Electron tube, type 7C7.....1
Electron tube, type 7A8 1
Electron tube, type 6V6GT.....1
Resistor, thermal, type 4H12.....1
Resistor, thermal, type 6-13.....1
Resistor, thermal, type 9-8.....1
Vibrator, nonsynchronous 2
Lamp, incandescent, 28 volts, .17 ampere 4
Fuse, cartridge, 5 amperes.....5
Fuse, cartridge, 10 amperes.....5

10. Additional Equipment Required

All equipment necessary for the normal installation and operation of Radio Set AN/VRC-2X is supplied. However, it may be necessary to secure additional mounting hardware and materials for special types of installations.

11. Differences in Models

Radio Set AN/VRC-2X is essentially a 24-volt version of Radio Set AN/VRC-2, which operates from a 6-volt power source. The principal difference is in the arrangement of the filament circuits. A dynamotor is used for transmitter plate power in Radio Set AN/VRC-2X and two vibrator power supplies are used in the transmitter of Radio Set AN/VRC-2. There are also minor differences in other circuit values, and in accessories (par. 63).

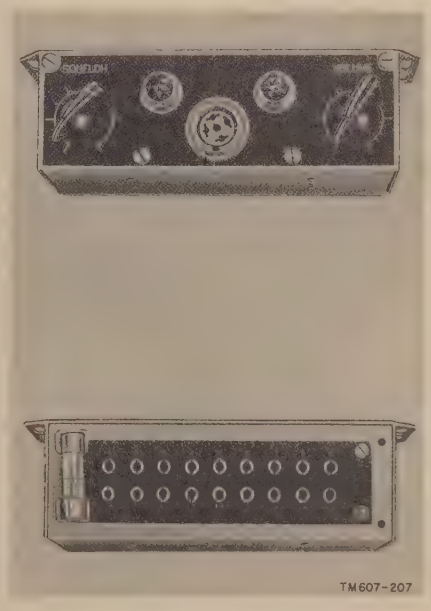


Figure 8. Radio Set Control C-1060/VRC-2X, front and rear view.

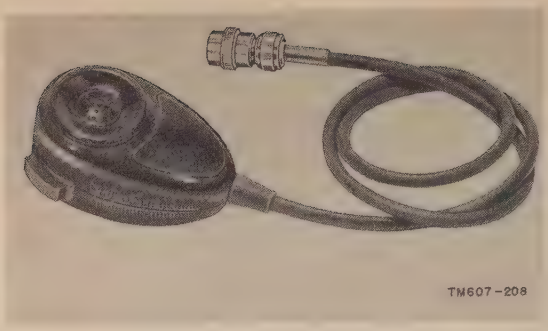


Figure 9. Microphone M-38/U.

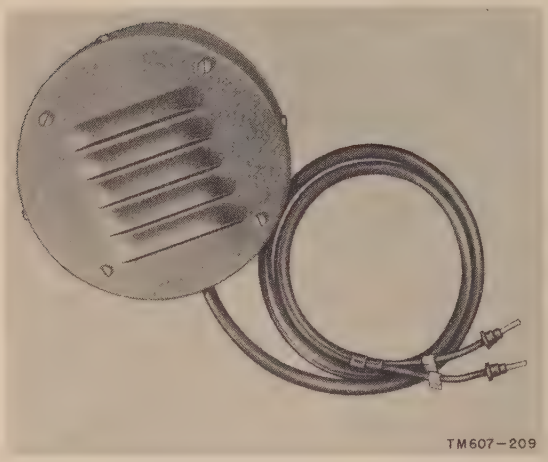


Figure 10. Speaker LS-158/U.

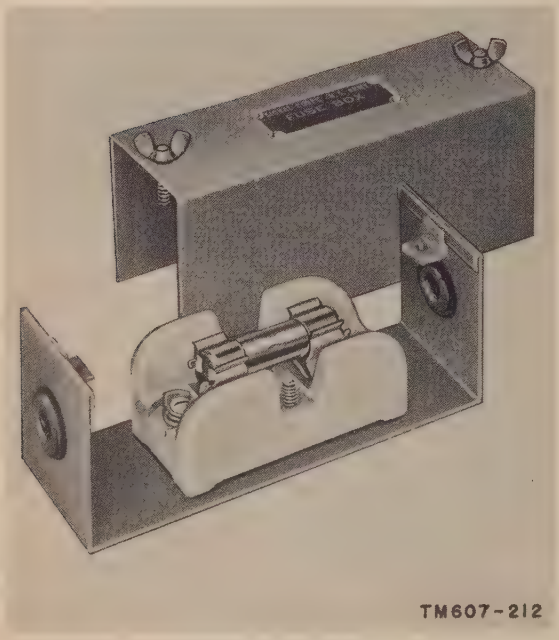


Figure 13. Fuse box.

Figure 11. Antenna AT-129/VR.

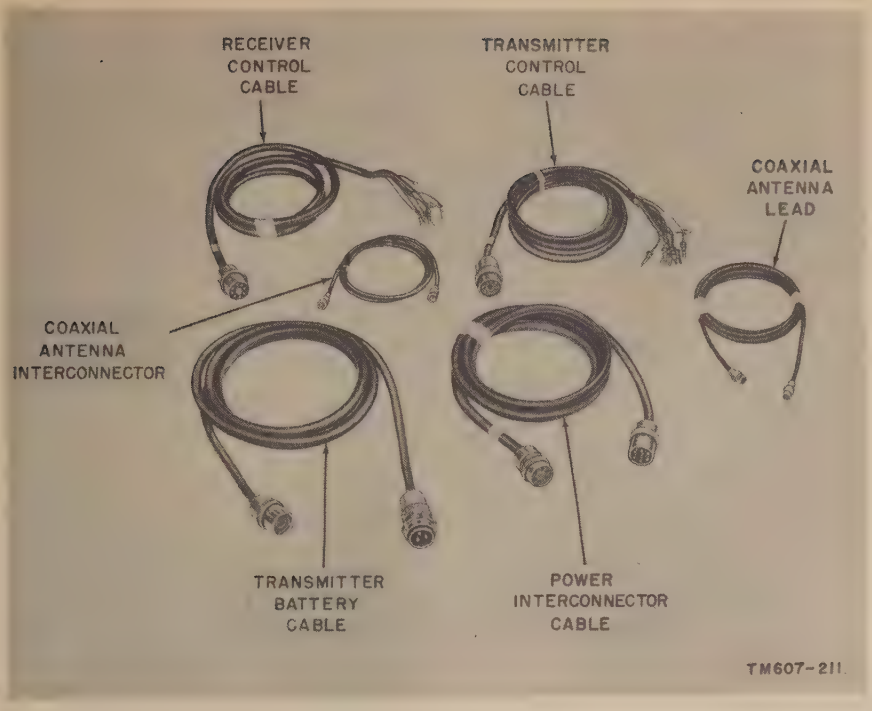


Figure 12. Radio Set AN/VRC-2X, cable kit.

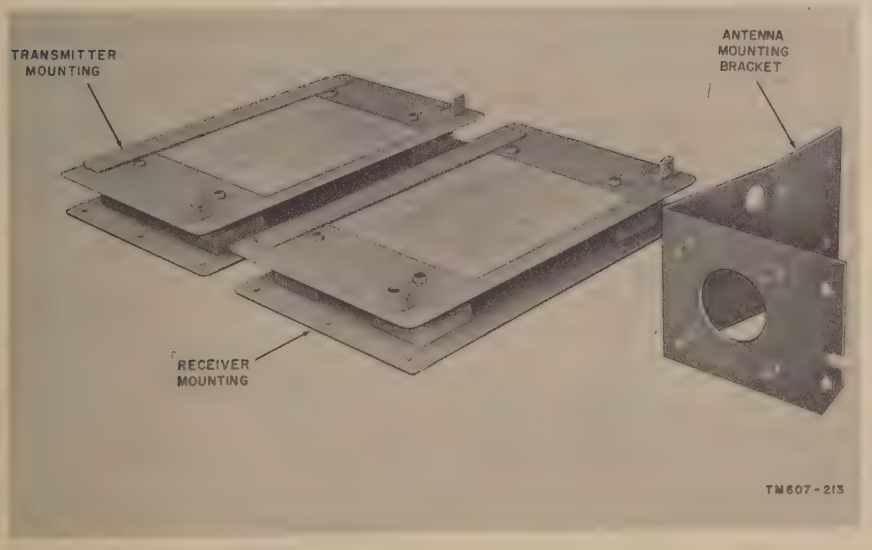


Figure 14. Receiver and Transmitter Mounting Plates

CHAPTER 2

OPERATION INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

12. Siting

Because of the frequencies involved, transmissions and reception with Radio Set AN/VRC-2X are most successful over line-of-sight paths. The equipment should be located, during periods of transmission and reception, in areas free of intervening obstacles such as hills, reinforced concrete structures, steel buildings, bridges, and other obstruction. These obstacles make communication difficult or impossible. Also avoid locating equipment near telephone and power lines. The best sites are high locations which command an unimpeded view of the surrounding terrain.

13. Uncrating, Unpacking, and Checking New Equipment (fig. 15)

Note. For used or reconditioned equipment refer to paragraph 16.

a. GENERAL. Equipment may be shipped in oversea packing cases (subpar. *b* below) or in domestic packing cases (subpar. *c* below) and, sometimes, in its own carrying cases. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements, and which is convenient to the permanent or semipermanent installation of the equipment.

Caution: Be careful in uncrating, unpacking, and handling the equipment; it is easily damaged. If it becomes damaged or exposed, a complete overhaul might be required or the equipment might be rendered useless.

b. STEP-BY-STEP INSTRUCTIONS FOR UNCRATING AND UNPACKING EXPORT SHIPMENTS. (1) Cut and fold back the steel straps.

(2) Remove the nails with a nail puller. Remove the top and one side of the packing case. Do not attempt to pry off the sides and top; the equipment may become damaged.

(3) Remove the moistureproof barrier and any excelsior or corrugated paper covering the equipment inside the case.

(4) Remove the equipment from its inner case and place it near its final location.

(5) Inspect the equipment for possible damage incurred during shipment.

c. UNPACKING DOMESTIC PACKING CASES. Radio equipment may be received in domestic packing cases. The instructions in subparagraph *b* above apply also to unpacking domestic shipments. No metal straps are used. Open the cartons that protect the equipment; or if heavy wrapping paper has been used, remove it carefully and take out the components. Check the contents of the packing case against the master packing slip.

Note. Save the original packing cases and containers for both export and domestic shipments. They can be used again when the equipment is repacked for storage or shipment.

14. Installation of Equipment (figs. 16 and 17)

a. GENERAL. Study the information provided with the equipment before attempting the installation. Make sure that the vehicle has a 24-volt electrical system. Using the information provided in figures 16 and 17, lay out a plan for the exact location of the various components. Be sure that the plan provides for a short lead between the transmitter and the antenna. Specific installation instructions for each type of vehicle are supplied with the mounting hardware. Radio Set AN/VRC-2X is usually supplied without the h-f (high-frequency) crystals for the receiver and the transmitter. It will be necessary to requisition the proper crystals for operation on the desired channel. Crystals for Radio Set AN/VRC-2X are mounted in Crystal Holder HC-1/U. Locations of the crystal sockets are shown in figures 51 and 58. Information for selecting the proper crystal for a specific frequency is given in paragraph 39. The proper crystal must be installed in each socket or the set will be inoperative.

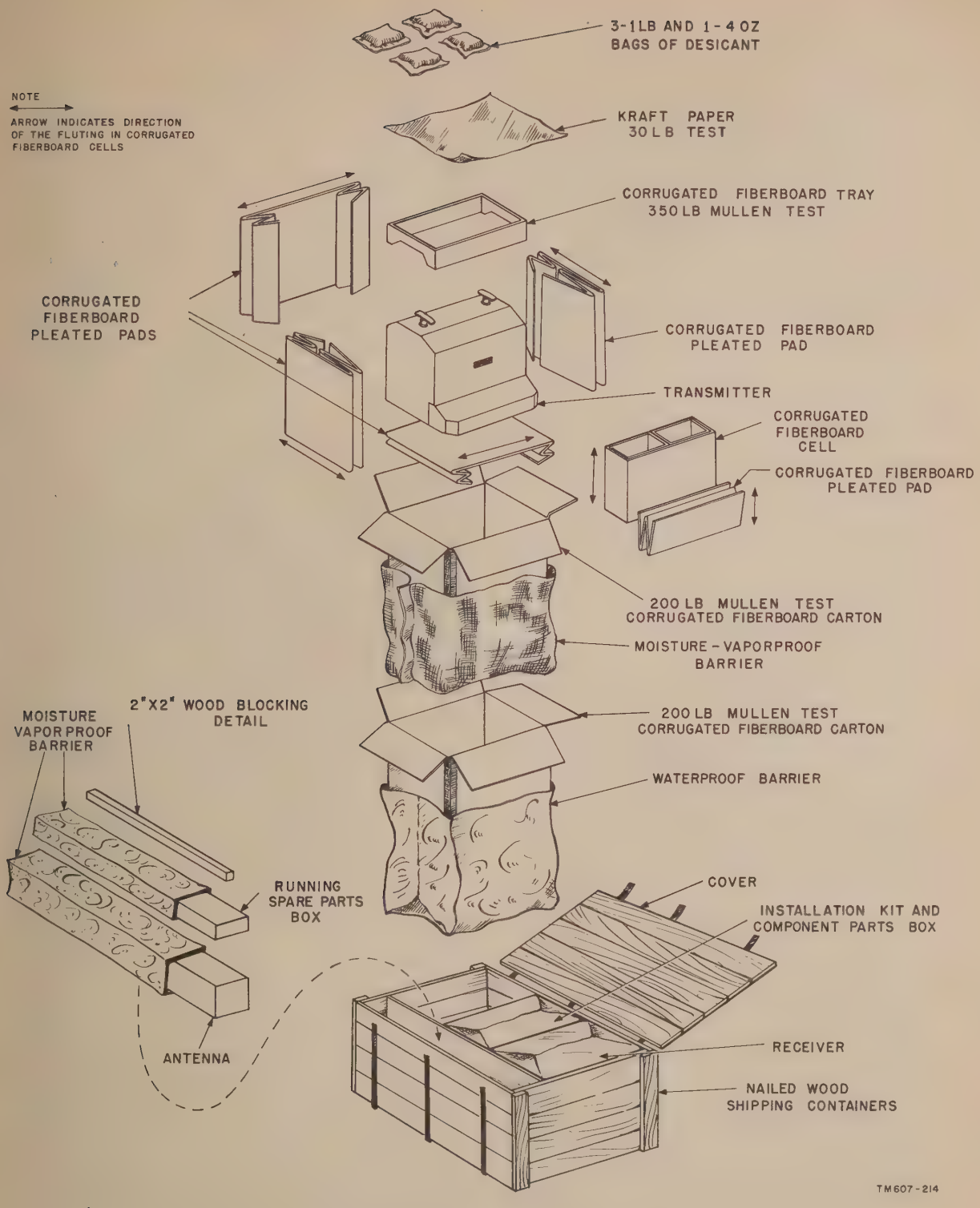


Figure 15. Radio Set AN/VRC-2X, packaging.

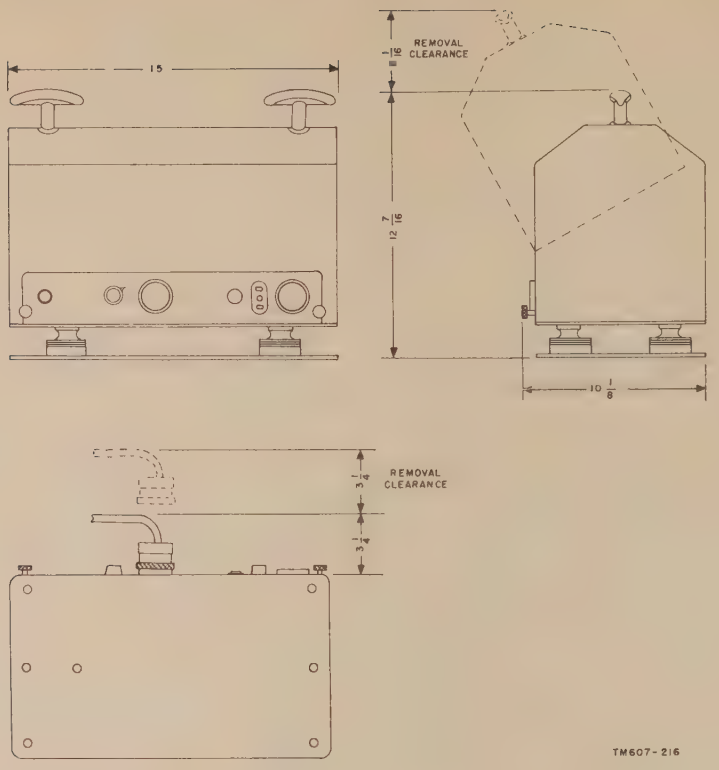


Figure 17. Outline dimensions for receiver and transmitter.

b. MOUNTING RECEIVER. (1) Secure shock mounting to vehicle, using hardware supplied. Loosen the thumbscrews on the front panel of the radio receiver and push the unit back on its base plate about ½ inch. This will unlock the rear edge of the chassis from the base plate. Lift the chassis off its base plate. Secure the base plate to the shock mounting with the ¼-inch screws and lockwashers. Ground the base plate to the shock mounting with a bond strap.

(2) Replace the chassis on the base plate. The base locking screws must be removed or unscrewed about ¾ inch, and the chassis must be squarely over the base plate and about ½ inch to the rear before it is lowered into position. The base plate locking screws will pull the chassis forward and lock it in place.

c. MOUNTING TRANSMITTER. (1) Before attempting installation of the transmitter, it is important to note whether the vehicle has a positive or negative ground and whether the low-voltage leads from the dynamotor agree with this polarity. Radio Transmitter T-322/VRC-2X is wired for installation in a vehicle with a negative ground. For a vehicle with a positive ground, it will be necessary to reverse the power connections to the low-voltage winding of the dynamotor. This is done by reversing the leads on either side of terminal block E23 (fig. 59) so that the positive side of the power source is connected to the positive (red) lead of the dynamotor primary winding.

(2) Mount the transmitter in the manner outlined for mounting the receiver.

d. MOUNTING CONTROL HEAD. The control head is usually mounted below the instrument panel using the two mounting brackets which are fastened at the ends.

e. MOUNTING SPEAKER. The speaker is attached to the vehicle by bolting the speaker mounting bracket to the vehicle body at the desired location.

f. INSTALLATION OF ANTENNA. (1) Locate the antenna at the left rear of the vehicle. The base insulator should be so mounted that it is near the transmitter antenna connector and high enough to allow sufficient antenna height.

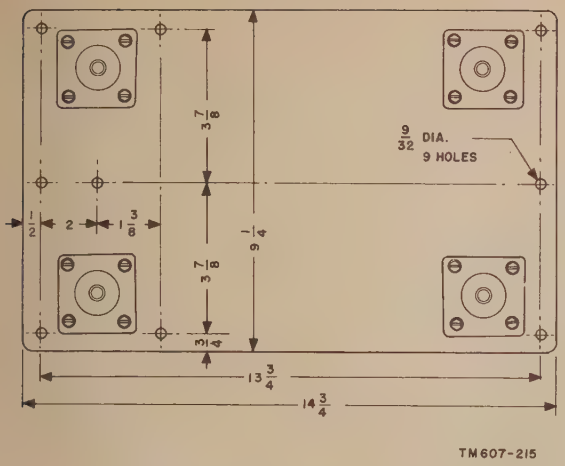


Figure 16. Mounting details for shock plates.

(2) Drill the required holes in the vehicle body and attach the antenna with the hardware supplied.

g. INSTALLATION OF FUSE BOX J-498/VRC-2X. The fuse box is inserted in the ungrounded lead to the battery. Secure the fuse guard to the vehicle wall under the hood and as close to the battery as practicable. Use the hardware furnished.

15. Connections (figs. 18 and 19)

Details of the necessary interconnections are illustrated in figures 18 and 19. It will be necessary to remove the covers, with switch guards attached, in order to make the cable connections. Make sure that all jacks and connectors make positive contact with their proper receptacles. Use the clamps supplied with the equipment to hold the cables securely in place.

16. Service upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 13 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes in wiring have been made, note the change in this manual, preferably on the over-all schematic and stage diagrams.

c. Check the operating controls for ease of rotation.

d. Perform the installation and connection procedures given in paragraphs 14 and 15.

Section II. CONTROLS

17. General

Haphazard operation or improper setting of the controls can cause damage to electronic equipment. For this reason, it is important to know the function of every control and connector. The actual operation of the equipment is discussed in Section III.

18. Controls and Connectors

a. RECEIVER. (fig. 20). The following table lists the controls and connectors of the receiver and their functions:

a. RECEIVER (fig. 20) (contd).

Control	Function
ANTENNA receptacle (J6)	Connector for coaxial cable connecting the receiver to transmitter connector.
METER SWITCH (SW1)	Switches an external meter to different parts of circuit during tuning procedure.
CONTROL connector (J5)	Connector for control head cable.
METER jack (J1)	Jack for connecting an external meter to receiver.
SPEAKER jack (J8)	Jacks for connecting the speaker to the receiver.
POWER connector (P1)	Connector for cable to RECEIVER connector on transmitter.

b. TRANSMITTER (fig. 21). The following table lists the controls and connectors of the transmitter and their functions:

b. TRANSMITTER (fig. 21) (contd).

Control	Function
ANTENNA connector (J3)	Connector for cable to antenna.
RECEIVER connector (J5)	Connector for cable to receiver ANTENNA receptacle.
METER jack (J1)	Jack for connecting an external meter to transmitter.
METER SWITCH (S1)	Connects external meter to different circuits of transmitter.
MIC connector (J2)	Connector for microphone cable. (Used during tuning process only.)
CONTROL connector (P1)	Connector for control head cord.
RECEIVER connector (J4)	Connector for cable to the POWER connector on receiver.
POWER connector (P2)	Connector for cable to battery.
FUSE receptacle (F1)	Holds transmitter fuse.

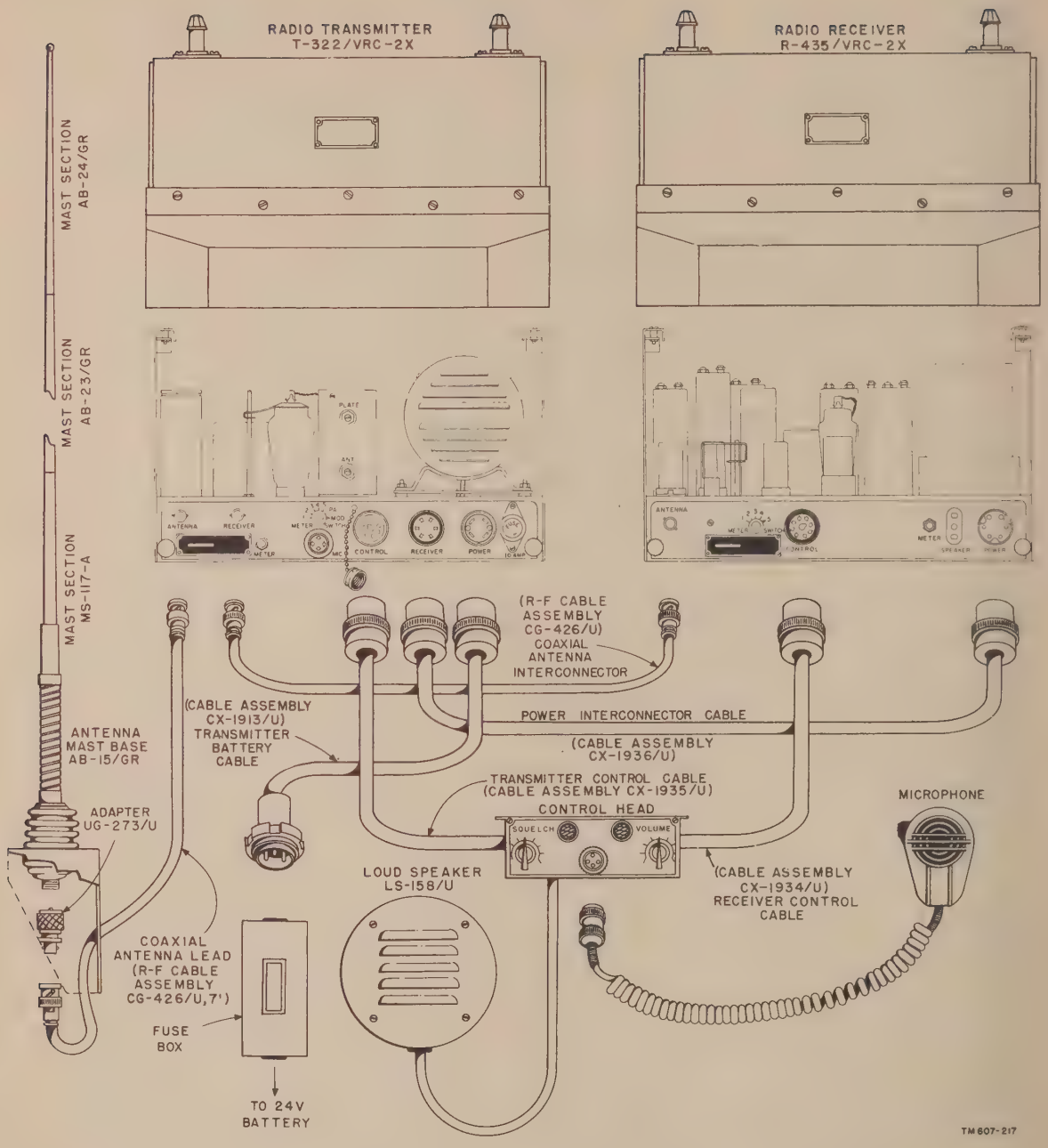


Figure 18. Radio Set AN/VRC-2X interconnections.

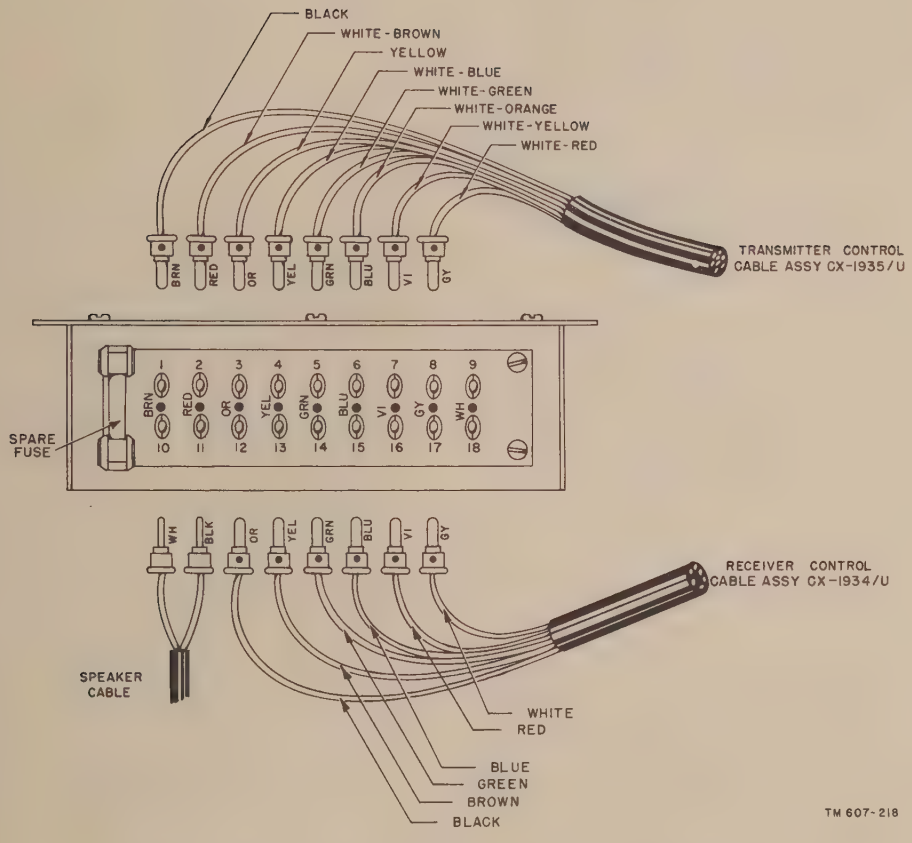


Figure 19. Radio Set Control C-1060/VRC-2X showing pin jack connections.

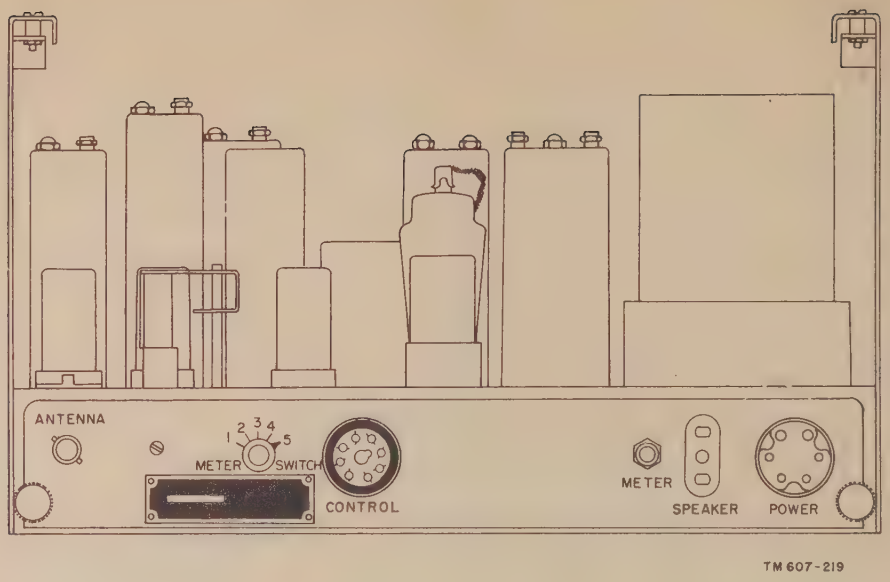


Figure 20. Radio Receiver R-435/VRC-2X, panel.

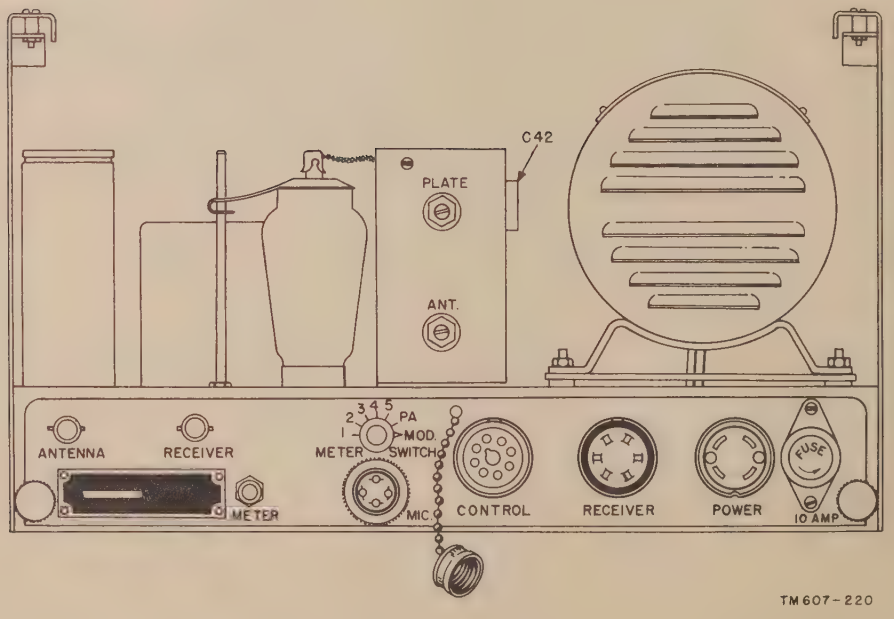


Figure 21. Radio Transmitter T-322/VRC-2X, panel.

c. CONTROL HEAD (fig. 8). The following table lists the connector and controls of Radio Set Control C-1060/VRC-2X and their functions:

c. CONTROL HEAD (fig. 8) (contd).

Control	Function
Microphone receptacle (J1)	Receptacle for microphone cable.
Lamp (M2)	Green lamp which indicates that receiver is energized.
Lamp (M3)	Red lamp which indicates that transmitter is energized.
VOLUME control (R4)	Combined power switch and volume control.
SQUELCH control (R3)	Determines noise level at which squelch action will start.

Section III. OPERATION UNDER USUAL CONDITIONS

19. Operating Procedure

Before applying power to the equipment, check to see that all cables are securely attached to their proper receptacles. Check the values of all fuses so that if a short circuit is present, the equipment will not be damaged. There should be a 10-ampere fuse in the receptacle on the transmitter panel, a 5-ampere fuse in the receiver power supply, and a 25-ampere fuse in the fuse guard located in the power line to the battery. A spare 10-ampere fuse is mounted at the rear of the control head. Check whether the h-f crystals in the transmitter and receiver have been installed. Crystal locations for the receiver and transmitter are shown in figures 51 and 58, respectively. Make sure that the equipment is wired to agree with the polarity of the vehicle (par. 14*c*).

a. RECEIVING. (1) Turn VOLUME control in a clockwise direction until a click is heard. This closes the power line switch and the receiver and transmitter filaments are energized. The green lamp on the control head should light.

(2) Wait 30 seconds for the tubes to become warm.

(3) Turn the VOLUME control in a clockwise direction three-fourths of its working distance. A rushing noise should be heard.

(4) With no signal being received, turn the SQUELCH control in a clockwise direction until the rushing sound is just eliminated.

(5) As the vehicle moves it may become necessary to adjust the SQUELCH control until the rushing sound is just eliminated with no signal being received.

(6) Keep the VOLUME control adjusted so that the received signal can be heard clearly.

b. TRANSMITTING. (1) Press the microphone push-to-talk button. The red lamp on the control head should light. The green lamp remains lit.

(2) Hold the microphone close to the mouth and talk directly into it. Speak distinctly and in a normal tone.

(3) When transmission has been completed, release the push-to-talk button. The red lamp should go out.

Caution: Do not allow the dynamotor to run more than 5 minutes out of every 10 minutes.

Caution: Do not start the vehicle motor when the equipment is in operation since the power supply vibrators may stick and be damaged.

20. Stopping Procedure

To turn the equipment off, turn the VOLUME control in a counterclockwise direction as far as it will go. The green lamp on the control head should go off. When starting the equipment again, it may be necessary to readjust the SQUELCH control.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

21. General

The operation of Radio Set AN/VRC-2X may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs, instructions are given on procedures for minimizing the effects of unusual operating conditions.

22. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. If possible, construct an insulated box for the receiver and transmitter.

c. Heavy coatings of frost will gather on mouth type microphones in extreme cold weather when the micro-

phones are used in the open air. Frost will form in the small holes of the microphone and will affect the clarity of the input signal. Rubber diaphragms have been designed to protect some types of microphones; use them when available. Try to have a spare microphone.

d. When equipment which has been exposed to the cold is brought into a warm room it will sweat until it reaches room temperature. This condition also arises when the equipment warms up during the day, after exposure during a cold night. When the equipment has reached room temperature, dry it thoroughly.

23. Operation in Tropical Climates

In tropical climates, the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the surrounding air. To minimize this condition, place lighted electric bulbs under the equipment or keep the filaments lit. Make sure that the equipment is moisture-fungi-proofed.

24. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same precautions to insure proper operation of the equipment.

b. The main problem which arises with operation in desert areas is the large amount of sand and dirt which enter the controls and the dynamotor. Keep the equipment as free from dust and dirt as possible.

c. Make frequent preventive maintenance checks. Pay particular attention to the lubrication of the dynamotor. Excessive amounts of sand or dirt that come in contact with oil and grease result in grit, which will damage the dynamotor.

CHAPTER 3

ORGANIZATION MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

25. Tools and Materials Required

Since no tools and materials are supplied with Radio Set AN/VRC-2X, it will be necessary to secure the following in order to perform proper preventive maintenance.

Common hand tools.
Clean cloth.
Sandpaper, #0000.
Crocus cloth.
Fine file or relay burnishing tool.
Paste metal polish (Signal Corps stock No. 6G1516).
Solvent, dry-cleaning (SD).
Contact burnishing tool.

Note. Gasoline will not be used as a cleaning fluid for any purpose. Solvent (SD) is available as a cleaning fluid through established supply channels. Oil, fuel, Diesel, may be used for cleaning purposes when solvent (SD) is not at hand. Carbon tetrachloride will be used as a cleaning fluid only in the following cases: where inflammable solvents cannot be used because of the fire hazard, and for cleaning electrical contacts, including relay contacts, plugs, commutators, etc.

26. Special Tools Issued for Radio Set AN/VRC-2X

No special tools are issued with Radio Set AN/VRC-2X.

27. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent certain troubles from occurring. See AR 750-5.

28. General Preventive Maintenance Techniques

a. Use #0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with solvent (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful however, or mechanical damage from the air blast may result.

d. For further information on preventive maintenance techniques, refer to TB SIG 178.

29. Use of Preventive Maintenance Forms (figs. 22 and 23)

a. The information in paragraph 30 is presented as a guide to the individual making an inspection of equipment in accordance with instructions on DA AGO Forms 11-238 and 11-239. The decision as to which items on the forms are applicable to this equipment is a tactical decision to be made in the case of First Echelon maintenance by the Communication Officer/Chief or his designated representative, and in the case of Second and Third Echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. The first two columns in the table in paragraph 30 serve as a cross reference between the item numbers of DA AGO Forms 11-238 and 11-239 and the preventive maintenance information in this manual.

30. Performing Preventive Maintenance

The following preventive maintenance operations should be performed at the intervals indicated, unless these intervals are reduced by the local commander.

Caution: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; Ⓧ Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).*							
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.							
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS.							
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS.							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION.							
6	CHECK FOR NORMAL OPERATION.							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CHASSIS RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, DIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS.		13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE.		14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN.		15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.		16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHER-PROOFING.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES.		18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

SAMPLE

DA AGO FORM 1 MAY 51 11-238 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TMCL-238

Figure 22. DA AGO Form 11-238.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE | EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).*	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS.	
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS.	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION.	
6	CHECK FOR NORMAL OPERATION.	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS, CONTROL SHAFT MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, [illegible] TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS.	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE.	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN.	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	

NO.	ITEM	CONDITION
19	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS; INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES.	
20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
22	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.	
23	INSPECT [illegible] CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT, [illegible] AND LOOSE MOUNTINGS.	
24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, [illegible]NG, BLISTERING, DISCOLORATION AND MOISTURE.	
25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS.	
26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	
27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.	
28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS.	
32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE.	
33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
37	MOISTURE AND FUNGIPROOF.	

38 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

SAMPLE

DA AGO FORM 1 MAY 51 11-239 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE. 16-10-84383-1

TMCL-239

Figure 23. DA AGO Form 11-239.

30. Performing Preventive Maintenance (contd)

DA AGO Form 11-238 item No.	DA AGO Form 11-239 item No.	DAILY
1	1	Check for completeness and satisfactory condition of the radio set. The components of the radio set are listed in paragraph 6 and are illustrated in figures 4 and 5.
2	2	Check suitability of location and installation for normal operation.
3	3	Clean dirt and moisture from antenna, microphone, headsets, chest sets, keys, jacks, plugs, carrying bags, and panels of the component parts.
4	4	Inspect the seating of the fuses and all plugs and connectors.
5	5	Inspect all controls for binding, scraping, excessive looseness, worn or chipped parts, misalinement, and positive action.
6	6	Check for normal operation (pars. 37, 38).
		WEEKLY
		Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.
7	7	Clean and tighten the panel mountings of the control head, transmitter, and receiver.
8	8	Inspect cases, mountings, antenna, and exposed metal surfaces for rust, corrosion, and moisture.
9	9	Inspect cords, cables, wires, and shock mounts for cuts, breaks, fraying, deterioration, kinks, and strain.
10	10	Inspect antenna for eccentricities, corrosion, loose fit, and damaged insulators.
13	13	Inspect storage batteries for dirt, loose terminals, electrolyte level, specific gravity, and damaged cases.
16	16	Inspect shelters and covers for adequacy of weatherproofing.

30. Performing Preventive Maintenance (contd.)

DA AGO Form 11-238 item No.	DA AGO Form 11-239 item No.	MONTHLY
	19	Inspect electron tubes for loose envelopes, loose cap connectors, cracked sockets, and insufficient socket spring tension; clean dust and dirt carefully; check emission of receiver type tubes.
	21	Inspect fixed capacitors for leaks, bulges, and discoloration.
	23	Inspect variable capacitors for dirt, moisture, misalinement of plates, and loose mountings.
	24	Inspect resistors, bushings, and insulators for cracks, chippings, blistering, discoloration, and moisture.
	25	Inspect terminals of large fixed capacitors and resistors for corrosion, dirt, and loose contacts.
	26	Clean and tighten switches, terminal blocks, relay case, and interiors of chassis and cases not readily accessible.
	27	Inspect terminal blocks for loose connections, cracks, and breaks.
	30	Inspect dynamotor for brush wear, spring tension, arcing, and fitting of commutator.
	31	Clean and tighten connections and mountings for transformers, chokes, potentiometers, and rheostats.
	32	Inspect transformers, chokes, potentiometers, and rheostats for overheating and oil leakage.

31. Lubrication

The dynamotor is the only part of Radio Set AN/VRC-2X which may require lubrication. Under normal operating conditions, the ball bearings of the dynamotor have a sufficient quantity of grease for the average life of the dynamotor. However, under some severe or abnormal operating conditions, the grease thins out. If additional lubrication is needed, remove the end caps and grease retainers of the dynamotor and apply only Grease, Aircraft and Instrument (GL) (Mil-G-3278) or Standard Oil Beacon No. 325 grease directly into the race of the bearings. Cover, but do not pack bearings. Avoid getting grease on the commutators and brushes.

32. Weatherproofing

a. GENERAL. Signal Corps equipment, when operated under severe climatic conditions, such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. TROPICAL MAINTENANCE. A special moisture-proofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72.

c. WINTER MAINTENANCE. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. DESERT MAINTENANCE. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

e. LUBRICATION. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69. Observe all precautions outlined in TB SIG 69. Refer to paragraph 31 for detailed instructions.

33. Rustproofing and Painting

a. When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use #00 or #000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used should be authorized and consistent with existing regulations.

Section III. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

34. Scope

The trouble shooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining which of the components is at fault, and in localizing the fault in that component to the defective stage or item, such as a tube or a fuse.

35. Visual Inspection

a. Failure of this equipment to operate properly will usually be caused by one or more of the following faults:

(1) Improperly connected battery cable.

(2) Worn, broken, or disconnected cords or plugs.

(3) Burned-out fuses.

(4) Relay contacts burned because of overloads.

(5) Wires broken because of excessive vibration.

(6) Defective tubes.

(7) Inactive (dirty or cracked) crystal.

(8) Defective primary power source.

b. When failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the component parts of the system. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

c. Inspect the antenna system for obvious defects.

36. System Sectionalization of Trouble to a Component

System sectionalization consists of determining whether the trouble is in the transmitter, receiver, control head, antenna, power source, microphone, or speaker.

a. Operate the radio set and observe its performance. See equipment performance checklist (par. 38) for normal operating indications.

b. If the entire radio set is dead, the trouble undoubtedly is in the battery or the main fuse.

c. If only one component is dead, the trouble is in that component and it is probably a fuse. Check fuses at an early stage in trouble shooting. Do not continue to burn out fuses before looking elsewhere to determine the basic source of the trouble.

d. The over-all operation of the transmitter r-f stages can be checked by the antenna current reading (par. 88).

e. If the receiver exhibits unsatisfactory performance, such as excessive noise, howling, or weak signals, replace it with a good receiver, if available. If the trouble disappears, the replaced receiver is defective. If the trouble persists, the trouble is not in the receiver but is either in the vehicle or is due to conditions external to the vehicle.

f. Disconnect the antenna. If the symptoms persist, the trouble is in the installation or the vehicle and may be ignition noise. If removal of the antenna causes the symptoms to become less pronounced or to disappear entirely, the trouble is in the antenna or is external to the vehicle.

g. By the use of procedures similar to the simple checks given above, the trouble can be isolated to a particular unit.

37. Trouble Shooting, Using Equipment Performance Checklist

a. GENERAL. The shipment performance checklist (par. 38) will help the operator to locate trouble in the equipment. The list gives the item to be checked, the conditions under which the item is checked, the normal indications of correct operation, and the corrective measures the operator can take. *In using this list, perform the checks in the sequence indicated.*

b. ACTION OR CONDITION. For some items, the information given in the action or condition column consists of various switch and control settings under which the item is to be checked. For other items it represents an action that must be taken to check the normal indication given in the normal indications column.

c. NORMAL INDICATIONS. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. CORRECTIVE MEASURES. The corrective measures listed are those the operator can make without turning in the equipment for repairs. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the tactical situation requires that communication be maintained, and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

38. Equipment Performances and Checklist (see page 25).

39. Changing Frequencies

a. GENERAL. Since Radio Set AN/VRC-2X may be operated between the frequencies of 30 to 40 mc, it is often desirable and necessary to change channel frequencies. Personnel using this equipment should become familiar with the frequencies outlined below.

b. RADIO RECEIVER R-435/VRC-2X. (1) To change frequencies in the receiver, it is necessary to insert the proper h-f crystal and to adjust C1 for the desired frequency. The correct frequency for the h-f crystal is calculated as follows:

(*a*) If the channel frequency is between 30 and 37 mc, subtract 4.3 and divide by 4.

(*b*) If the channel frequency is between 37 and 40 mc, subtract 4.3 mc and divide by 5.

(2) Antenna trimmer C1 is adjusted for maximum meter reading with the METER SWITCH in position 1. (Aline receiver by following the procedure in paragraph 78.)

(*c*) RADIO TRANSMITTER T-322/VRC-2X. To change channels in the transmitter, proceed as follows:

(1) Insert a crystal whose frequency is 1/32 of the output frequency.

(2) Insert the proper plate tank coil L1 based on the following information:

Frequency range (mc)	*Number of turns*
30.0 to 33.0	8
33.0 to 37.0	7
37.0 to 40.0	6

(3) Aline the transmitter by following the procedure outlined in paragraph 79.

38. Equipment Performance Checklist

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	1	VOLUME control.	Turn control clockwise.	Click is heard as switch is closed.	Tighten VOLUME control knob on shaft.
				Green lamp on control head lights.	Check battery and cable connections, Replace lamp, check fuses.
			Turn clockwise three-fourths of total working distance, with SQUELCH control in extreme counterclockwise position.	Rushing noise is heard in loudspeaker after 30-second warmup period.	Check SQUELCH control to make sure it is in extreme counterclockwise position.
EQUIP. PERF.	2	SQUELCH control.	Turn control clockwise.	Rushing noise in loudspeaker ceases abruptly as control reaches point to start squelch action.	Tighten SQUELCH control knob on shaft.
	3	VOLUME control.	Signal being received. Turn control clockwise.	Volume of signal increases.	Tighten VOLUME control knob on shaft.
	4	SQUELCH control.	Control set at proper operating point.	No noise heard in loudspeaker when no signal is being received.	Advance setting of SQUELCH control in clockwise direction to point where noise stops.
				Weak signals are received clearly.	Retard setting of SQUELCH in counterclockwise direction until weak signal is heard clearly.
	5	Push-to-talk switch on microphone.	Press switch button.	No noise or signal heard.	Check microphone connections.
				Red lamp on control head lights.	Replace lamp.
			Release push-to-talk button.	Noise or signal heard.	
				Red lamp on control head is extinguished.	
STOP	6	VOLUME control.	Turn control to extreme counterclockwise position.	Click is heard as power switch opens.	Tighten VOLUME control knob on shaft.
				Green lamp on control head is extinguished.	

CHAPTER 4

THEORY

Section I. THEORY OF RADIO RECEIVER R-435/VRC-2X

40. Block Diagram (fig. 24)

a. Radio Receiver R-435/VRC-2X is an f-m double-conversion superheterodyne type receiver. The term double-conversion means that the received signal beats against an h-f oscillator signal to produce a first intermediate frequency; this frequency then beats with the output of a second oscillator to produce a second i-f of a lower frequency. The discriminator demodulates the second i-f signal which is then fed to the a-f (audio-frequency) stages when it is amplified and applied to the speaker. Limiting, squelch, and noise stages help improve the performance of equipment.

b. The received signal is amplified by r-f (radio-frequency) amplifier tube, V1, and fed to mixer V3. A signal which is 4.3 mc lower in frequency than the received signal is also applied to the mixer tube from the h-f oscillator tube, V2. The difference frequency of 4.3 mc is then amplified by V4.

c. The amplified 4.3-mc signal is applied to converter tube, V5, where it beats against a 4755- or 3845-kc signal and a difference frequency of 455 kc is obtained. The 455-kc signal is then amplified by tube V6 and fed to the first limiter tube V7. The grid of the first limiter is connected to the grid of squelch tube V12 so that it controls the operation of the squelch circuit.

d. The output of the first limiter is coupled to the second limiter tube V8 where further limiting action takes place to insure a constant amplitude signal to discriminator tube V9. The discriminator demodulates the signal, which is then filtered, and the noise component is fed to the noise amplifier tube, V10, where it is amplified. The amplified noise signal is then rectified by V11 and applied to V12 for squelch operation.

e. The discriminator audio output is also applied directly to the first a-f amplifier, V12. Part of the bias of the a-f section of V12 is controlled by the squelch section of V12 so that when no signal is received, the audio section of V12 can be biased beyond cut-off. V13 is a conventional a-f amplifier.

41. R-f Amplifier (fig. 25)

a. The first stage of the receiver is an r-f amplifier which uses a type 6SG7GT tube. The stage is conventional and increases the sensitivity and selectivity of the receiver.

b. The signal input is coupled to the r-f amplifier stage through the antenna transformer composed of coils L1 and L2. This voltage is applied to the grid of V1, amplified, and impressed across the tuned primary of T2R. The signal is coupled to the mixer stage through the secondary of T2R and capacitor C10.

c. Grid bias for V1 is developed across cathode resister R2 which is bypassed by capacitor C3. Capacitor C1 is used to tune L2 to the desired frequency. Screen voltage is applied through dropping resistor R3, and the r-f is bypassed by capacitor C4. Capacitor C9 resonates the plate coil of V1 to the desired frequency. Resistor R4 and capacitor C11 form a decoupling network for the plate circuit of V1. The tertiary winding of T2R, resonated by C75, forms a 4.3-mc wave trap for any undesired signals at the first i-f frequency. Capacitor C76 tunes the secondary of T2R to the desired frequency. Resistor R5 is the grid resistor for mixer V3. Resistor R54 is used to lower the impedance of the antenna input circuit. This will prevent oscillation when the antenna is removed for alinement purposes.

42. H-f Oscillator (fig. 26)

a. The h-f oscillator tube 6SG7GT generates a signal which beats with the received signal to produce a 4.3-mc i-f. The tube is used in a tri-tet oscillator circuit and the frequency of the circuit is determined by crystal XTAL 1. See paragraph 39 for selecting proper crystal to produce the 4.3-mc i-f signal.

b. The cathode coil is resonant to a frequency slightly lower than the lowest crystal frequency used. The plate circuit is tuned to the fourth or fifth harmonic, depending on the frequency of the received signal and the frequency of the crystal, by the primary of T1R and C7. Plate voltage is applied through R53, which is bypassed by C8. R7 is the screen dropping resistor and is bypassed by C6. The output of the oscillator is coupled to the mixer stage by the secondary of T1R, which is tuned by C77, and then is coupled through C5 to the mixer. R6 functions as a grid leak resistor.

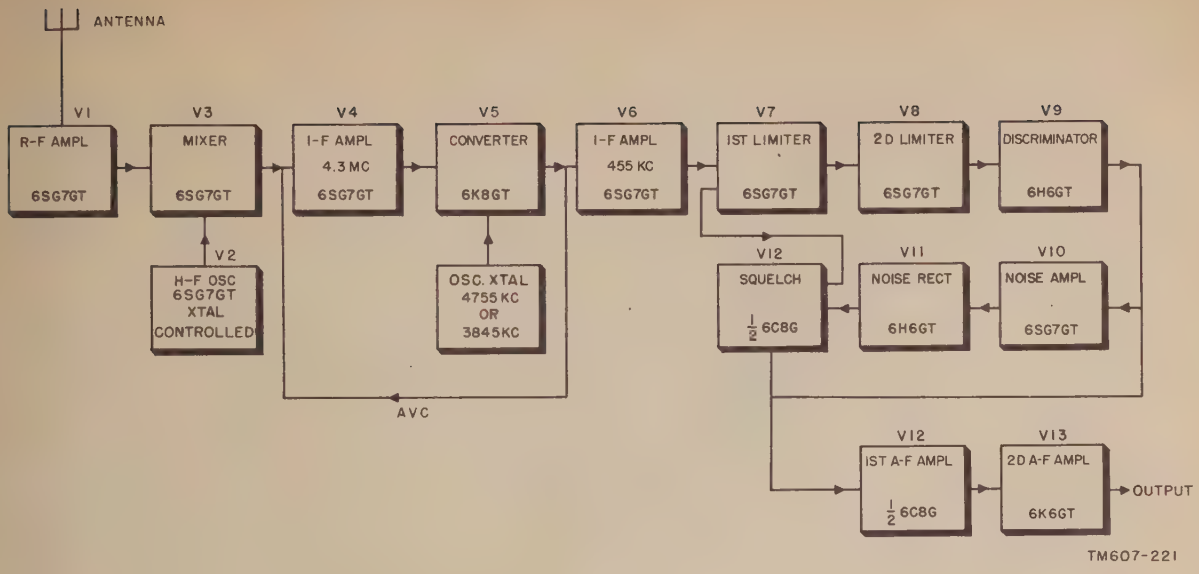


Figure 24. Radio Receiver R-435/VRC-2X, block diagram.

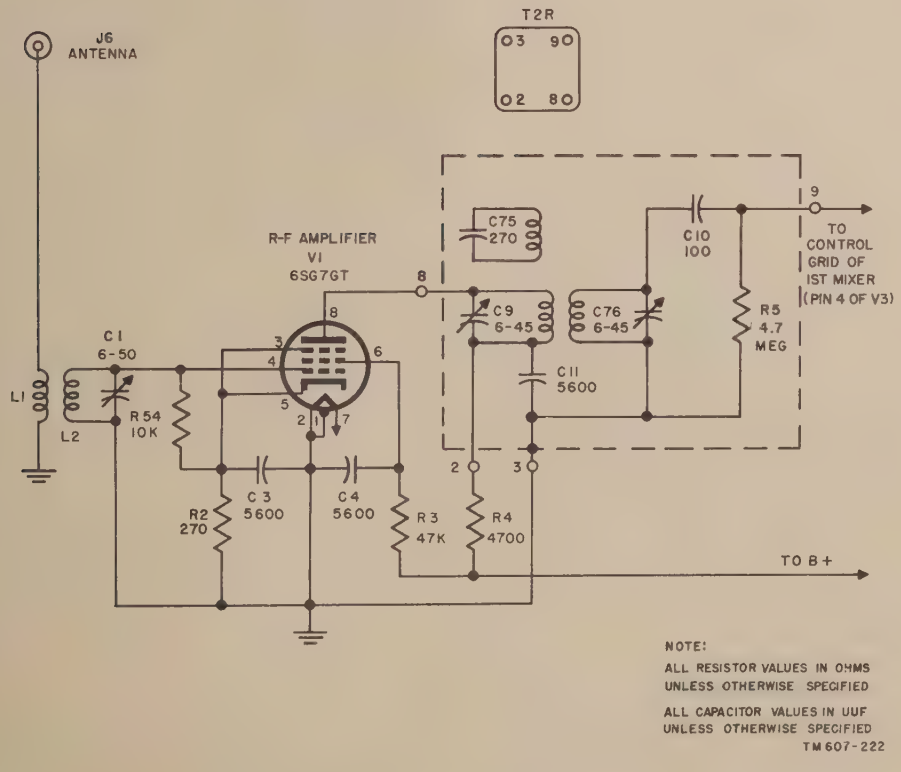


Figure 25. R-f amplifier, functional diagram.

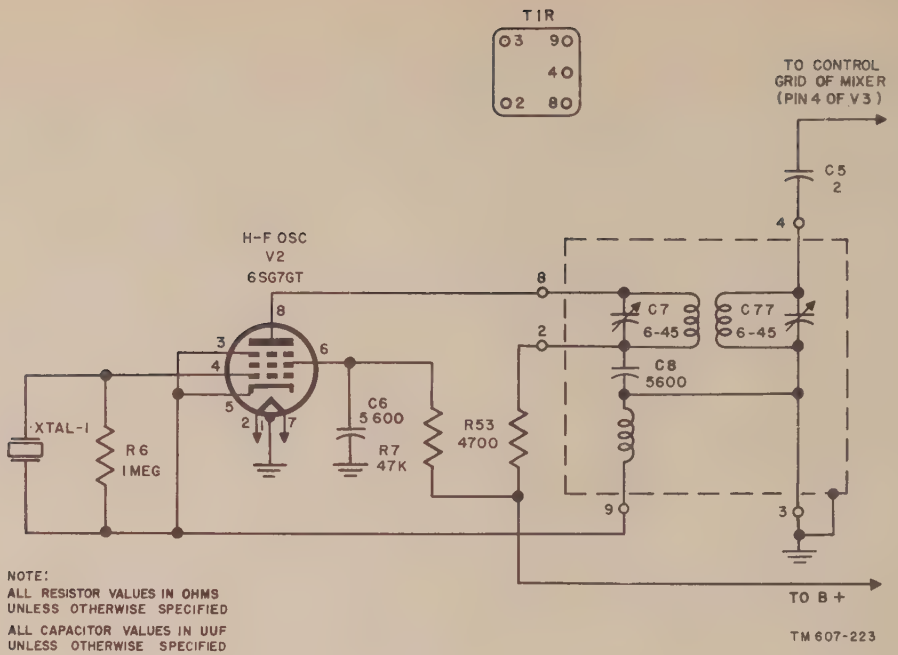


Figure 26. H-f oscillator, functional diagram.

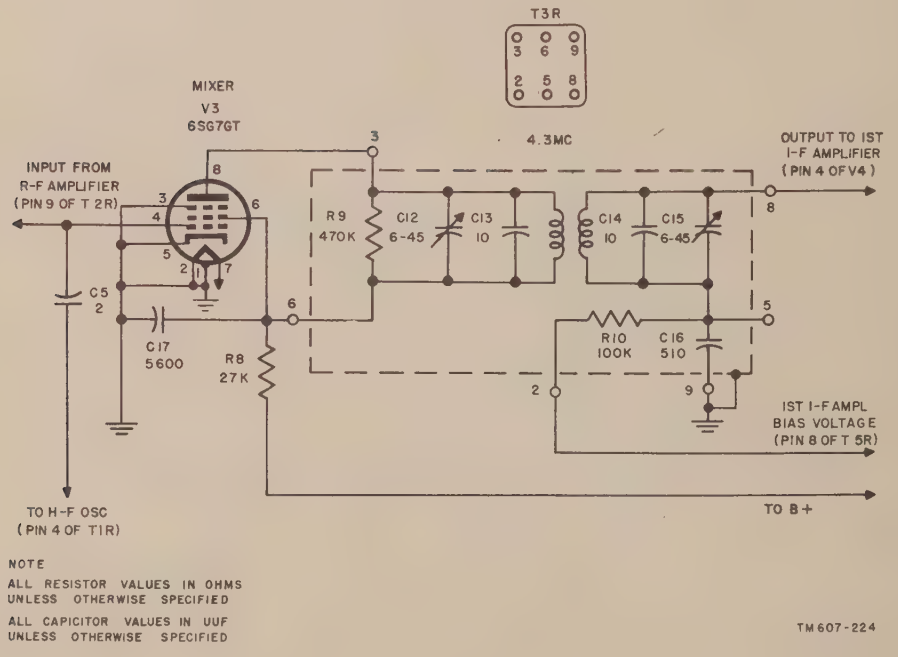


Figure 27. Mixer, functional diagram.

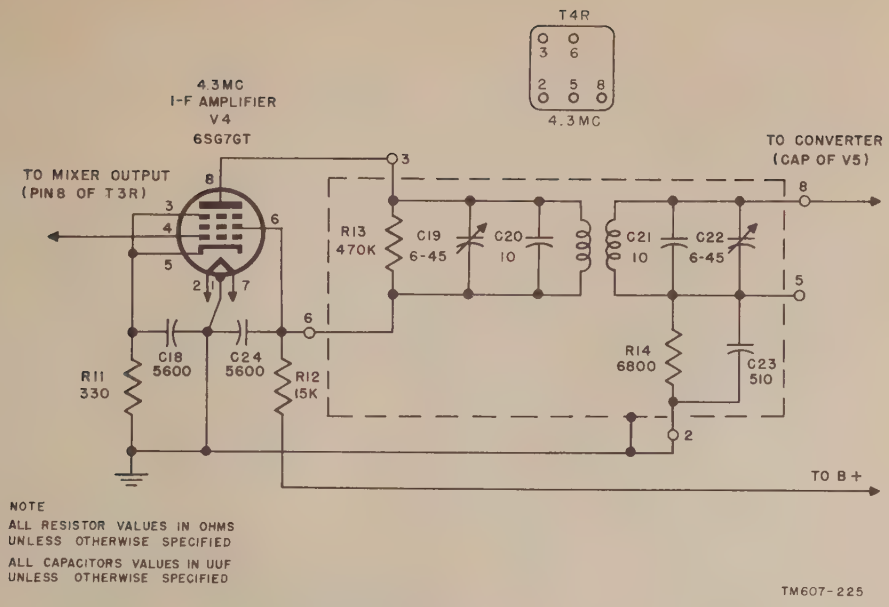


Figure 28. 4.3-mc i-f amplifier, functional diagram.

43. Mixer (fig. 27)

a. The mixer stage, V3, beats the output of V1 with the output of stage V2, extracts the difference frequency of 4.3 mc and couples it to the following stage.

b. The received signal frequency and the h-f oscillator frequency, which is 4.3 mc lower in frequency, are applied to the control grid of the mixer. The difference frequency is selected in the plate circuit and fed into the primary of T3R which is tuned to 4.3 mc. Capacitors C12 and C13 tune the primary to the desired frequency, and resistor R9 broadens the band-pass characteristics of T3R. Capacitors C14 and C15 tune the secondary of T3R to 4.3 mc. Resistor R8 and capacitor C17 from a decoupling network for the plate and screen. of V3. Resistor R10 and capacitor C16 form a decoupling network for the avc (automatic volume control) voltage which is applied to the grid of V4.

44. 4.3-mc I-f Amplifier (fig. 28)

a. The 4.3-mc amplifier stage uses a 6SG7GT tube in a conventional amplifier circuit arrangement. The high i-f provides good image rejection because of the wide separation between the desired and image frequencies.

b. Bias voltage is developed across cathode resistor R11 which is bypassed by capacitor C18. The plate circuit is resonated to 4.3 mc by the primary of T4R and capacitors C19 and C20. Resistor R13 broadens the band-pass characteristics of the primary tuned circuit of T4R. The secondary of T4R is tuned to 4.3 mc by capacitors C21 and C22. R12 and C24 form a decoupling network for the plate and screen. Resistor R14, which is bypassed by capacitor C23, is the grid resistor for V5.

45. Converter (fig. 29)

a. The converter stage consists of an oscillator and a second mixer which reduces the 4.3-mc i-f to 455 kc. This stage uses a 6K8GT tube which is a dual section tube. The hexode section functions as a mixer and the triode section serves as a crystal-controlled Pierce oscillator. The 4.3-mc signal from V4 is applied to the cap of V5. The signal generated by the triode section of V5 is applied to the hexode section internally since both sections have a common cathode and control grid. The output of V5 is tuned to the difference frequency, 455 kc.

b. The oscillator section has a quartz crystal, XTAL 2, connected from plate to grid in a Pierce oscillator circuit. Bias is obtained by current flow through resistor R16. Since R16 is connected directly to the cathode, not to ground, the triode section of V5 is not biased by current flow through R15. Resistor R15, bypassed by capacitor C25, is the cathode bias resistor for the hexode section.

c. Since the first grid and cathode are common to both sections, the r-f voltage on the oscillator grid modulates the voltage in the mixer section. This results in combining the oscillator signal with the input signal from the preceding stage.

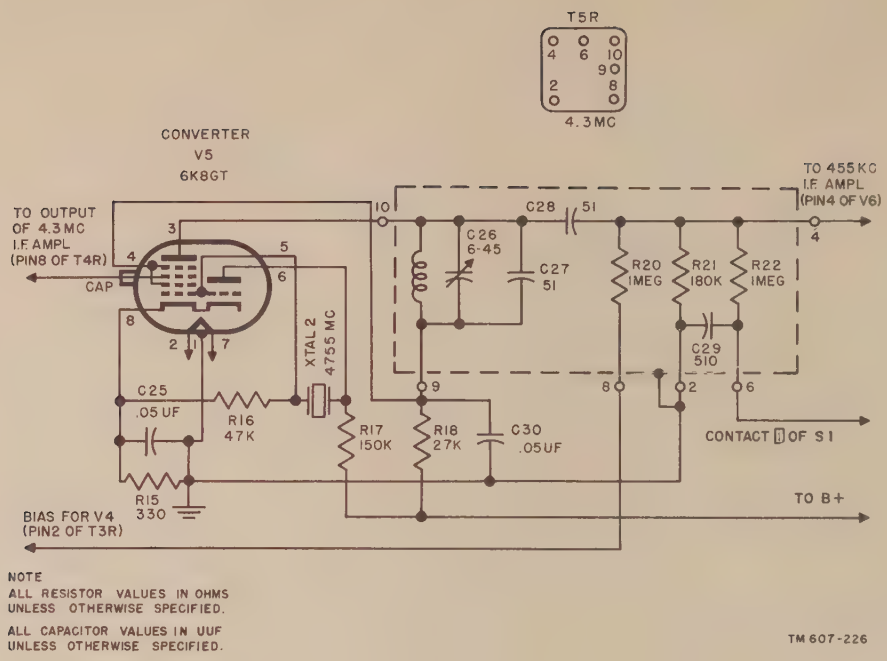


Figure 29. Converter, functional diagram.

d. R18 and C30 form a decoupling network for the plate and screen of the hexode section. Plate voltage for the oscillator section is applied through load resistor R17. The plate circuit of the hexode section is tuned to 455 kc by the inductance in T5R resonated by capacitors C26 and C27. The output of V5 is fed to the following stage through capacitor C28 which also keeps the plate voltage from the grid of V6.

e. Avc (automatic volume control) voltage is also taken from T5R. On a strong signal, the grid draws current and provides a negative voltage at the grid of V6. The stronger the signal, the more negative will be this voltage. This voltage is fed back through filter resistors R20 and R10 to the control grid of V4. Since the voltage is applied as grid bias to the 4.3 mc i-f amplifier, the gain of this stage wll be controlled by the avc voltage applied. Resistor R22 and capacitor C29 constitute a decoupling network in the lead to the meter switch.

46. 455-kc I-f Amplifier (fig. 30)

a. The 455-kc amplifier uses a 6SG7GT tube in a conventional amplifier circuit. This stage increases the sensitivity and selectivity of the equipment.

b. The 455-kc signal from the preceding stage is applied to the control grid of the amplifier, amplified, and inductively coupled to the following stage by T6R. T6R is tuned to 455 kc by capacitors C33, C34, C35, and C36. Resistors R25 and R26 broaden the frequency response characteristics of T6R. Resistor R24, and capacitor C32 form a decoupling network for the plate and screen. Normal bias for this stage is provided by cathode resistor R23 which is bypassed by C31.

c. Resistor R29 is the grid leak bias resistor for V7 and is bypassed to ground by capacitor C37. The bias voltage developed at the grid end of R29 is coupled to the squelch tube V12 through a filter circuit composed of R27, R19, and C38. Resistor R28 is a multiplier resistor in position 2 of the meter circuit.

47. First Limiter (fig. 31)

a. The first and second limiter stages insure a constant voltage signal to the discriminator. Limiting, materially reduces the audible noise output of the receiver without affecting the intelligence carried by the f-m signal. The limiting action of the positive half-cycles occurs in the grid circuits of the tubes. During the negative half-cycle, limiting occurs in the plate circuits.

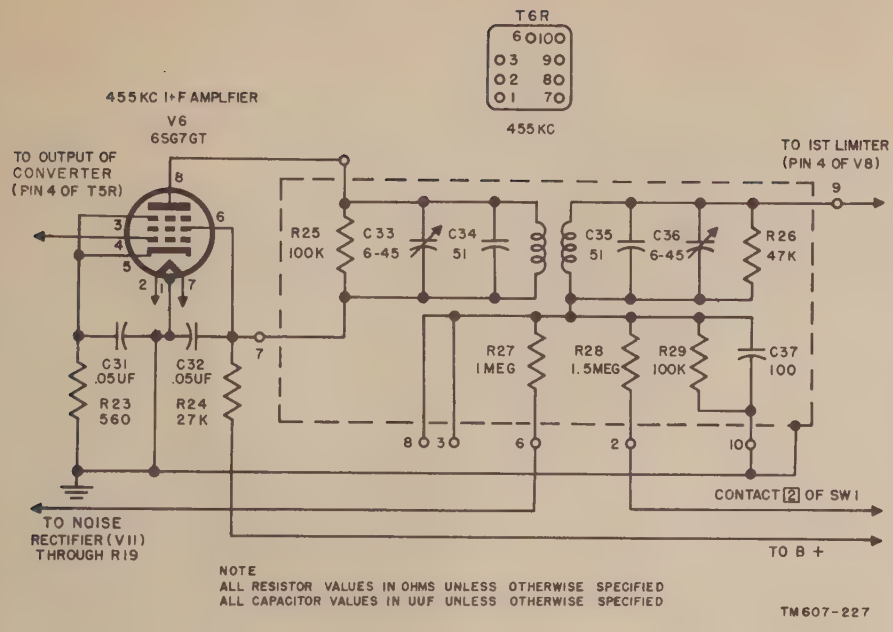


Figure 30. 455-kc i-f amplifier, functional diagram.

b. The 455-kc signal is applied to the grid of V7. The peak amplitudes of the signal extend over a greater voltage range than the usable dynamic range of the tube. The positive peaks of the signal cause V7 to draw grid current and the plate current to reach saturation. The negative peaks drive the tube to plate current cut-off. When the grid draws current, grid leak bias is developed. The bias developed at the control grid is an indication of the i-f drive; therefore maximum meter current at position 2 indicates maximum drive.

c. Capacitors C40 and C41 tune the primary of T7R to 455 kc. The secondary is tuned by capacitors C42 and C43. R30 and C39 form a decoupling network for the plate and screen. Resistor R31 is a meter multiplier resistor in position 3 of the meter switch. R32, bypassed by C44 provides the bias for the second limiter stage.

48. Second Limiter (fig. 32)

The second limiter operates in a manner similar to the first limiter and is used to reduce further the amplitude variation. The signal from the first limiter is applied to the grid of V8. Plate and screen voltage is applied through decoupling resistor R33 which is bypassed by C45. Coupling to the discriminator is through T8R.

49. Discriminator (fig. 32)

a. The function of the discriminator circuit is to convert the frequency variations of the 455-kc signal into amplitude variations which will occur at an audio rate.

b. T8R is composed of two separate transformers. The HIGH secondary section is tuned to 480 kc, which is 25 kc above the 455-kc input signal, by capacitors C46 and C47. The LOW section of T8R is tuned to 430 kc, which is 25 kc below the 455-kc input signal, by capacitors C50 and C51. Two half-wave rectifiers (one 6H6GT type tube) are connected in a back-to-back arrangement across each transformer secondary winding with a load resistor (R34 and R36) in series with each diode. When the voltage across each tuned circuit is of proper polarity, each rectifier conducts, current flows through the load resistors, and a voltage is developed across them. The direction of electron flow in each diode circuit is indicated by the arrows in figure 32. The polarity of the voltage drop across each load resistor, R34 and R36, is positive at the end toward the cathode, and negative toward the plates, as shown in figure 32. Since the negative sides of the load resistors are connected, the two voltages oppose each other, and the resultant voltage between point A and ground will be the difference between the individual voltages across

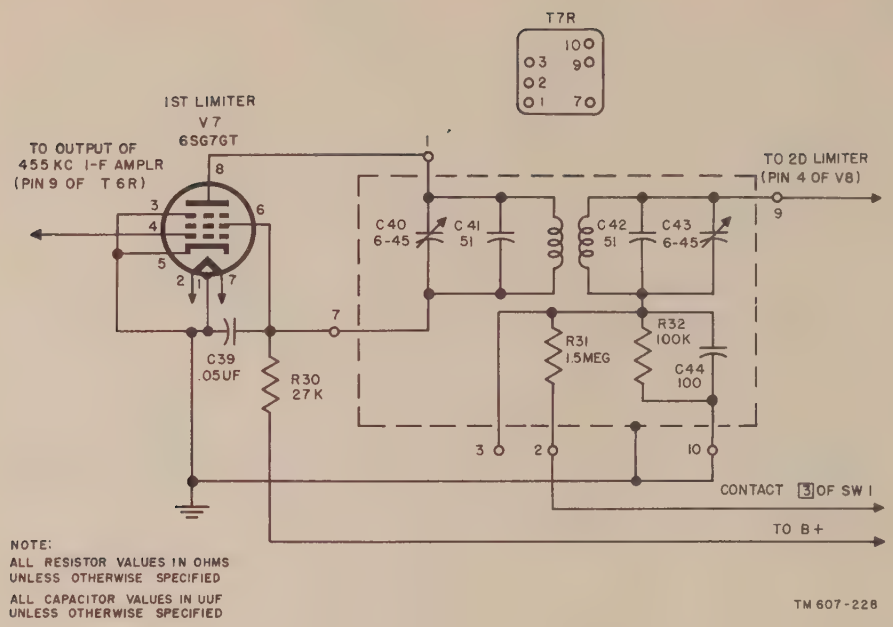


Figure 31. First limiter, functional diagram.

the diode load resistors. The resultant polarity will be that of the greater voltage. When the intermediate frequency is at center frequency, equal currents are drawn, the voltages across R34 and R36 cancel, and the output at A to zero. When the input frequency is higher than the center intermediate frequency, there is more voltage developed across the high-tuned circuit than across the low-tuned circuit, more current flows through R34 than through R36, and the polarity of the output from A to ground is positive. When the input frequency is lower than the center intermediate frequency, the reverse occurs; more current flows through R36 than through R34, and the output is negative.

c. Curves I and II (fig. 33) represent the voltages applied across load resistors R34 and R36. The resultant voltage at any one frequency is obtained by algebraically adding the individual diode load voltages. Only at 455 kc is the resultant voltage zero. From this illustration it can be seen that if the input frequency of the f-m signal varies at the rate of 1,000 cps (cycles per second), the resultant voltage will be a 1,000-cycle audio voltage; frequency variations are thus changed into an audio signal. The greater the frequency swing of the f-m signal, the greater will be the amplitude of the audio signal.

d. Capacitors C48 and C49 bypass r-f variations around the load resistors. Resistors R35 and R37 are multiplier resistors in the meter circuit.

50. Noise Amplifier and Noise Rectifier (fig. 34)

a. The noise amplifier and noise rectifier stages are provided to permit the equipment to operate only when signals are received, thus the operator will hear only received signals and no noise between periods of signal reception.

b. The output from the discriminator consists of an audio component and an h-f component which is called the noise component. The noise component of the discriminator output is applied to the grid of V10 through a filter system composed of R38, C52, and R39. C52 presents a higher impedance to the audio output of the discriminator than to the noise output. This filter system is provided to insure that only the noise component frequencies will be applied to the noise amplifier. V10 is a conventional amplifier whose gain is varied by R3, the SQUELCH control in the control head. R3 varies the cathode bias of V10. C53 and C56 are bypass capacitors for the cathode and screen, respectively. Plate voltage is applied through dropping resistor R40. The amplified noise component

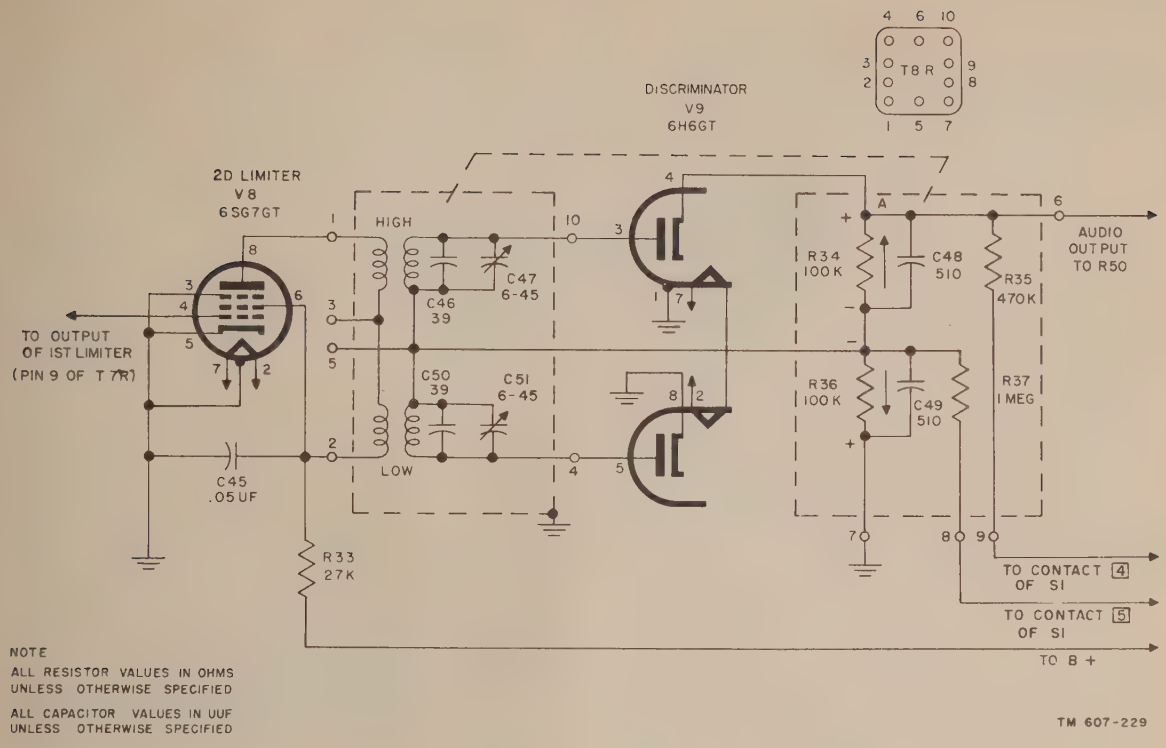


Figure 32. Second limiter and discriminator, functional diagram.

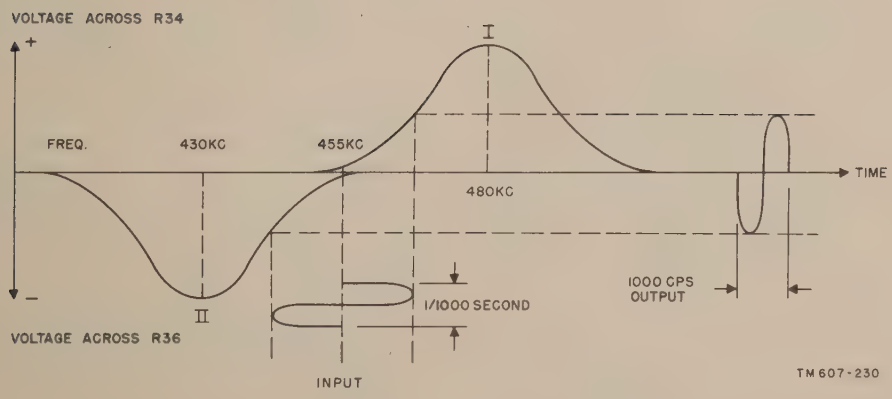


Figure 33. Voltage waves across discriminator load resistances.

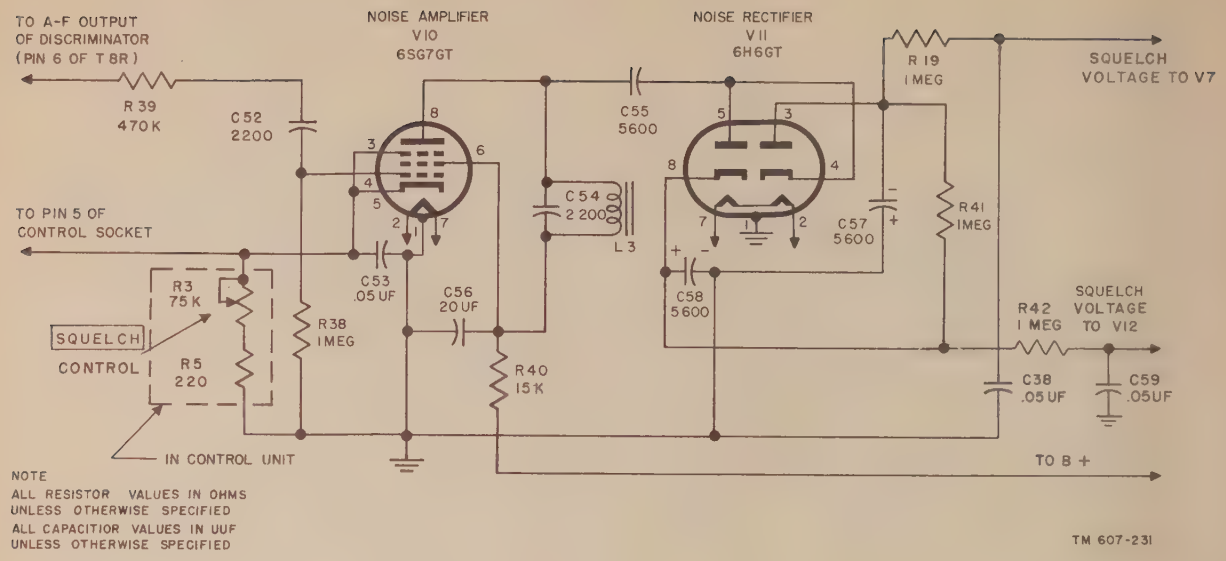


Figure 34. Noise amplifier and noise rectifier, functional diagram.

is developed across the plate load consisting of L3 and C54. The plate load is resonated to the band of frequencies of the noise component so that the amplified output contains nothing but noise impulses. The output of V10 is coupled to the following stage by C55.

c. The noise rectifier stage rectifies the output of V10 and applies it to the grid of the first limiter and to the grid of the squelch section of V12. The first diode builds up a positive potential to ground across C58. The second diode builds up a negative potential to ground across C57. Capacitors C57 and C58 discharge through R41 when the noise component is removed. The negative voltage across C57 is applied to the grid of V7, thereby reducing the gain of the first limiter. The positive potential across C58 is applied to the grid of V12 so that the squelch section will conduct. When the squelch section conducts (par. 51), the a-f amplifier section will be cut off, thus disabling the receiver. Resistor R-42 and capacitor C59 form a low-pass filter to prevent any a-f from operating the squelch (fig. 74).

51. Squelch and First A-f Amplifier (fig. 35)

a. The squelch section of V12 functions as a d-c amplifier, which provides cutoff bias for the first a-f amplifier when no signal is received. The grid-leak bias of V7 is applied to the squelch grid of V12 through resistors R27, R19, R41, and R42. Under a no-signal condition, this bias voltage from V7 is small enough to allow the squelch section of V12 to conduct. The positive output of the noise rectifier is also applied to the squelch grid, and causes the squelch section of V12 to conduct more heavily. When the squelch conducts, plate current flows through R44 and causes a voltage drop across it. The positive end of R44 is connected to the cathode of the amplifier section of V12 through R46. The negative or less positive end of R44 is connected to the grid of the amplifier section of V12 through R43. Thus, the voltage drop across R44 increases the bias for the amplifier section of V12 and is sufficient to prevent the amplifier from operating. When a signal is received, the grid-leak bias on V7 is increased. This increase is coupled to the squelch grid of V12 and the squelch is cut off. When the squelch no longer conducts, the current flow through R44 ceases and the bias on the a-f amplifier is reduced. The amplifier then operates normally, with cathode bias provided by R46.

b. The voltage divider, composed of R47 and R45, is used to provide a very low positive voltage for the plate of the squelch section of V12. Capacitors C60 and C61 are bypass capacitors used in the plate circuit of the squelch and cathode circuit of the a-f amplifier, respectively.

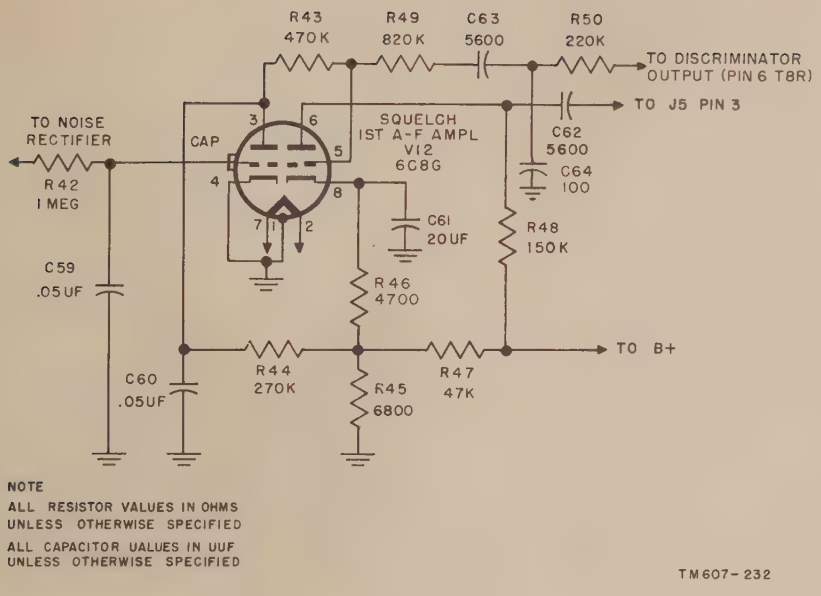


Figure 35. Squelch and first a-f amplifier, functional diagram.

c. When signals are received, the audio output of the discriminator is coupled to the grid of the a-f amplifier through a filter system composed of R50, C64, C63, and R49. R50 and C64 de-emphasize the higher audio frequencies. The amplified output appears across load resistor R48 and is then coupled to the grid of the second a-f amplifier through C62 and the VOLUME control (R4) in the control head (fig. 36).

52. Second A-f Amplifier (fig. 36)

a. The second a-f amplifier stage further increases the audio output of the receiver to provide sufficient drive for a speaker.

b. The audio input is applied to the control grid and is amplified in a conventional manner. Bias is developed across cathode resistor R52. R51 is the grid return resistor. Screen voltage is applied directly, and plate voltage is applied through the primary of T3. The output voltages are available at the impedance level of 3 ohms for the voice coil of the speaker, and 600 ohms for remote operation. Capacitor C74 improves the frequency response of the 600-ohm output.

53. Power Supply PP-721/VRC-2X (fig. 37)

Power Supply PP-721/VRC-2X is a conventional vibrator pack which is mounted on the same chassis with the receiver, and supplies all power requirements of the receiver.

a. Components. The major components of the power supply are the 24-volt vibrator E1, the power transformer T1, and two full-wave rectifier tubes 6X5GT, V1 and V2, connected in parallel. The 24-volt input at pin 6 of POWER plug P1 is filtered by choke L1 and capacitors C1 and C2. Choke L2 provides additional filtering for the receiver filament circuits. The vibrator input and the receiver filament circuits are protected against overload by FUSE F1. C5 bypasses to ground any r-f voltages appearing in the low-voltage input. C7 provides additional capacity for bypassing h-f variations to ground.

b. Vibrator Operation. Current flows from ground to pin 1 of the vibrator, through the driving coil to pin 2, then through half of the primary of transformer T1, out through the center-tap pin 2, and through the

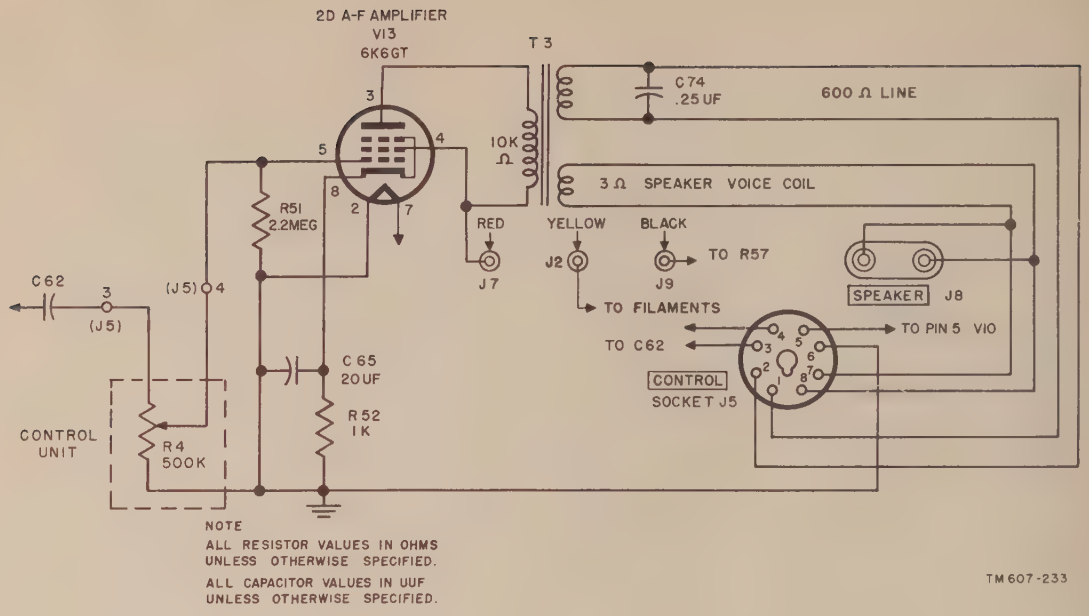


Figure 36. Second a-f amplifier, functional diagram.

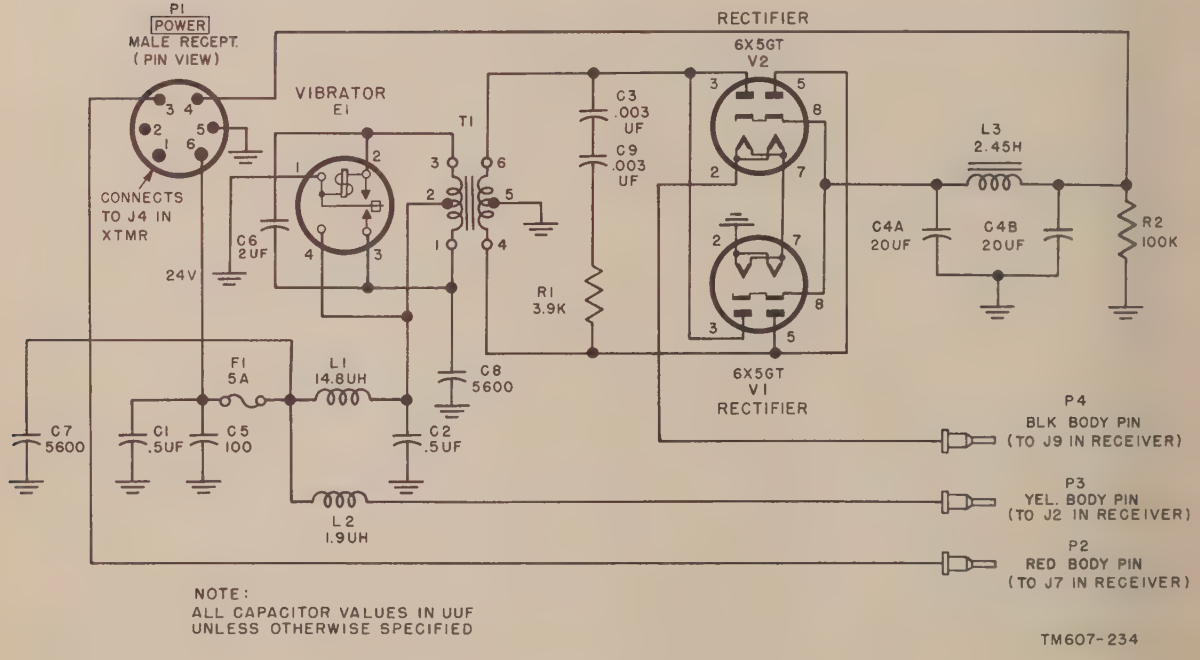


Figure 37. Power Supply PP-721/VRC-2X, schematic diagram.

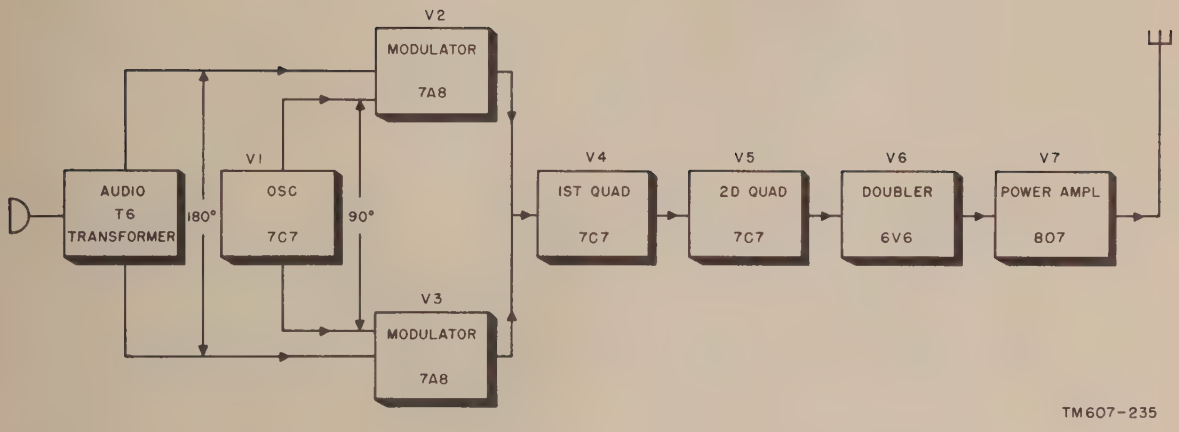


Figure 38. Transmitter, block diagram.

filter choke L1 and FUSE F1, to return to the battery. When the driving coil is energized, a magnetic field is developed which attracts the reed until it closes contact 2. When contact 2 is closed, the driving coil is shorted out, its magnetic field collapses, and the reed springs back to neutral position. Its momentum carries it beyond the neutral position until it closes contact 3. Battery current then flows through the second half of the primary of T1, but in the opposite direction. The reed is returned by spring action to the neutral position and is accelerated by the magnetic pull of the driving coil through which current is again flowing. The reed is pulled again to contact 2 and short-circuits the driving coil. The cycle is then repeated. The driving coil is periodically short-circuited. As the reed vibrates, battery current flows alternately in opposite directions through each half of the primary of T1. Thus an alternating current is produced in the primary of T1, which is stepped up in the secondary to approxmately 265 volts. Capacitor C8 provides an a-c ground and an h-f filter for variations in the vibrator circuit. Capacitor C6 is connected across the primary of T1 and filters the current wave developed by the vibrator. The buffer circuit formed by C3, C9 ,and R1 further improves the waveform.

c. RECTIFIER. The output of the secondary of T1 is rectified by V1 and V2, with one section of each tube conducting on each half-cycle of the output of T1. The rectified output is filtered by capacitors C4A and C4B, and choke L3. Resistor R2 is a bleeder for maintaining a minimum current through the output filter circuit.

d. TERMINALS. The battery input to the vibrator is from pin 6 of Power plug P1 and FUSE F1. The 24-volt input is filtered and is applied through choke L2, plug P3, and jack J2 (fig. 74) to the receiver filaments and to thermal resistor R57 where it is dropped to approximately 12 volts, which is then used for the series-connected filaments of the rectifier tubes. The 12-volt potential from R57 is applied to the rectifier filaments through jack J9 and plug P4. The high-voltage output from the rectifier is connected to pin 4 of POWER plug P1, through the power interconnector cable to pin 4 of RECEIVER jack J4 in the transmitter, and then to switching relay RY3. In the unenergized receive position of relay RY3, the high-voltage is returned to the power supply through pin 3 of RECEIVER jack J4 and pin 3 of POWER plug P1 and is then applied to the receiver plate circuits through plug P2 which connects to jack J7 (fig. 74).

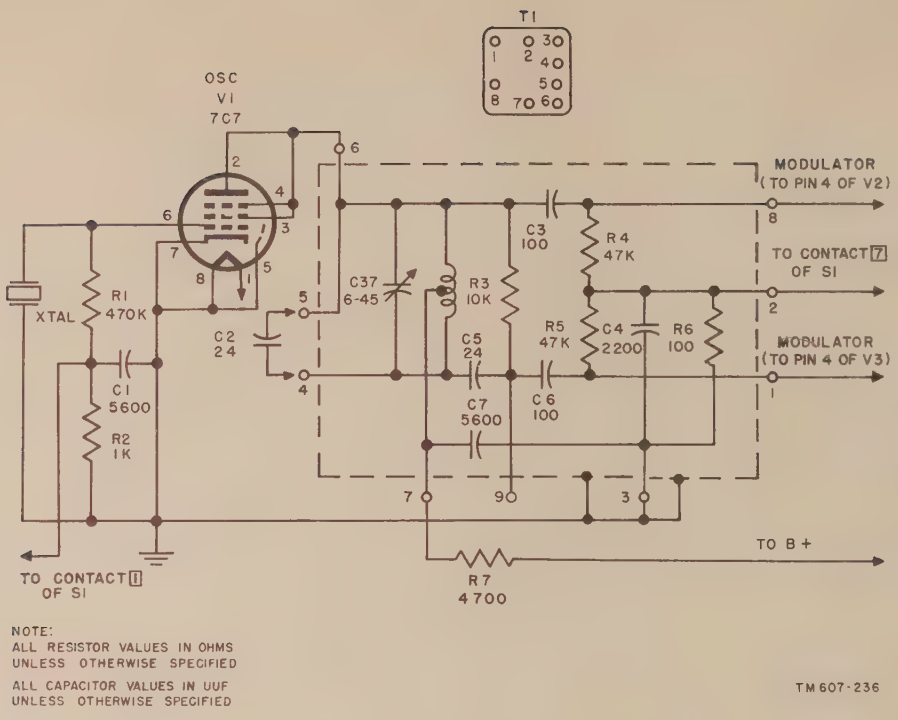


Figure 39. Transmitter oscillator, functional diagram.

Section II. THEORY OF RADIO TRANSMITTER T-322/VRC-2X

54. Block Diagram of Transmitter (fig. 38)

a. Radio Transmitter T-322/VRC-2X uses a phase modulating circuit to produce the f-m output. The output of the crystal, which is a submultiple of the final frequency, is fed to the modulator tubes, V2 and V3, with a phase difference of 90°. The modulator tubes also receive input voltages differing in phase from each other by 180°. The function of the modulator tubes is similar to mixing.

b. The output from V2 and V3 is then multiplied in frequency 32 times by V4, V5, and V6. V7 is a conventional power amplifier used to obtain an output of 30 watts.

55. Oscillator (fig. 39)

a. The oscillator stage provides a fixed submultiple of the output resting frequency. This stage consists of a quartz crystal, a 7C7 tube which is connected as a triode, and an output network which provides two outputs differing in phase by 90°.

b. Oscillation is maintained by feedback through the plate to grid capacitance of V1. Grid bias is provided by grid-leak resistors R1 and R2. R2 is also a meter shunt in switch position 1. This position is for measuring the oscillator grid current. C1 is a bypass for r-f voltages in the meter circuit.

c. Plate voltage is applied at the center of the plate coil, which is tuned by C37 and C2. Since the center of the plate coil is grounded for r-f by C7, the two ends of the tuned circuit are 180° out of phase. The r-f voltage developed across the entire coil appears across C5 and R3. R-f current flows through C5 and R3. The voltage across R3 is in phase with the current through it but the voltage across C5 lags the current through it by 90°. Therefore, the voltages across C5 and R3 are 90° out of phase. Thus, although the r-f voltages at the two ends of the tuned circuit are 180° out of phase, the r-f voltages at the two ends of R3,

(with respect to ground) are only 90° out of phase. The voltage across the upper half of the tank coil is applied through C3 to the grid of V2 (fig. 75). The vector sum of the voltage across the lower half of the tank coil and the voltage across C5 is applied to the grid of V3 through C6. This voltage is 90° out of phase with the voltage applied to the grid of V2.

d. Resistor R6, bypassed by capacitor C4, serves as a meter shunt for modulator grid current. Resistor R7 and capacitor C7 form a decoupling network for the plate and screen. Capacitor C2 is used only when the transmitter operates at frequencies below 33 mc. Resistors R4, R5, and R6 provide grid bias for the modulator tubes.

56. Modulator (fig. 40)

a. To produce the required f-m signal, tubes V2 and V3 are connected as a balanced modulator. The modulator output is phase-shifted by an amount determined by the amplitude and frequency of the audio signal and at a rate determined by the frequency of the audio signal.

b. Voice energy at the microphone causes a pulsating dc in the primary of the microphone transformer T6. The a-c voice component appears across the secondary of T6. The secondary of T6 is center-tapped to ground. This permits two a-f outputs, opposite in polarity, or 180° out of phase, to be taken from the ends of the secondary of T6. These a-f outputs from T6 are applied 180° out of phase to the signal grids of V2 and V3. The oscillator inputs to the modulator tubes are 90° out of phase (par. 55*c*). The mixing of the r-f and a-f voltages in the modulator tubes results in a varying phase shift in the plate circuit at the frequency of the a-f input.

c. In figure 41, if line OA_1 represents the r-f output of V2, then OA_2 will represent the r-f output of V3, 90° out of phase. With no a-f input, OA will represent the r-f output voltage of the modulator. When an a-f signal is applied to the signal grid, the transconductances of V2 and V3 will be 180° out of phase with each other. When the transconductance of V2 is at minimum, the output is at minimum, while the trans-

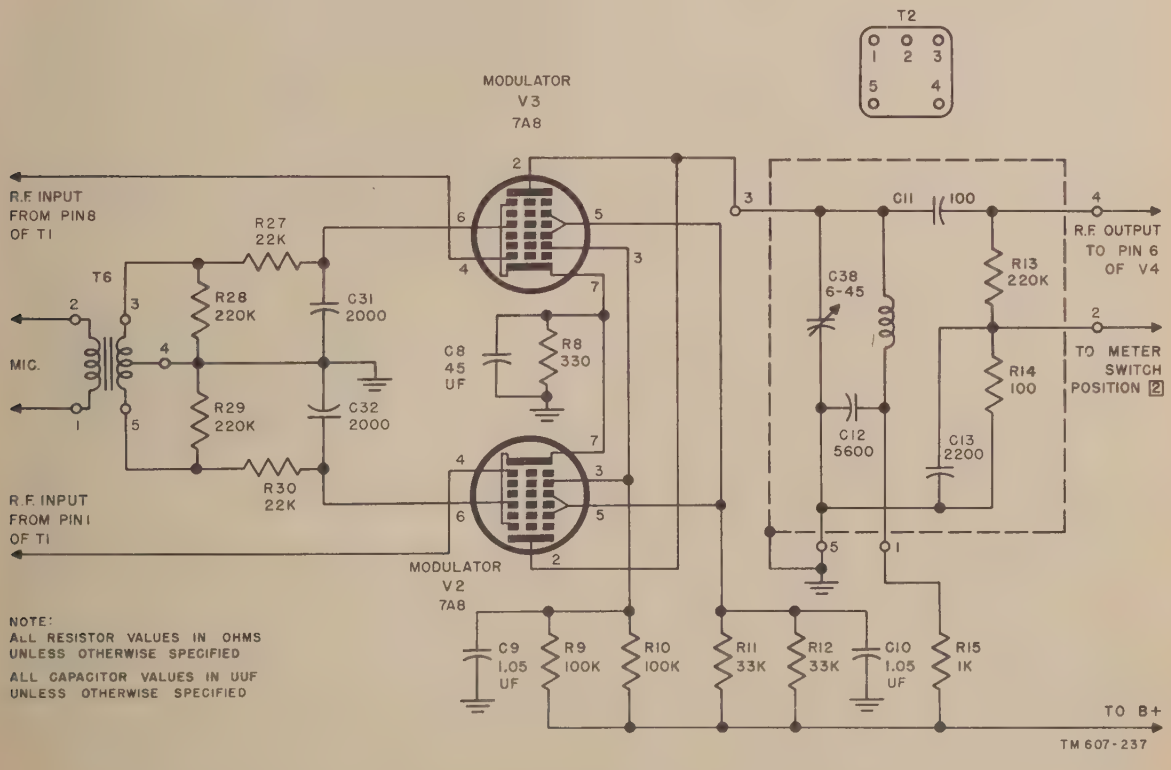


Figure 40. Modulator, functional diagram.

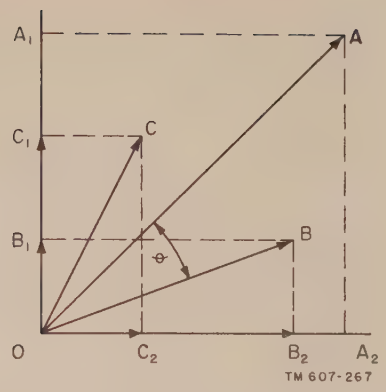


Figure 41. Modulator input voltages, vector diagram.

conductance and the output of V3 is at maximum. OB_1 represents the output of V2 and OB_2 represents the output of V3 in this condition. The output will be OB phase-shifted by zero degrees. The phase shift thus developed will be in proportion to the amplitude of the a-f signal. The phase shift is equivalent to a frequency shift which is proportional to the amplitude of the audio input. In phase modulation, the amount of frequency shift is also proportional to the frequency of the audio signal. The amount of frequency shift will therefore depend on both the amplitude and the frequency of the audio signal, and the rate of frequency shift will depend on the audio frequency. OC represents the output of V2 when the transconductance is at maximum and the transconductance of V3 is at minimum. The phase-modulated output is thus an f-m voltage, whose resting frequency is the frequency of the crystal oscillator.

d. Resistors R27, R28, R29, and R30, together with capacitors C31 and C32, attenuate the higher frequencies. This frequency discrimination is necessary in order to offset a characteristic of this type of phase modulation; the frequency deviation being dependent on both the amplitude and the frequency of the applied audio voltage. This network makes the amplitude of the audio signal, as applied to the modulator, almost inversely proportional to its frequency, thus partially compensating for the frequency shift in the modulator, which is directly proportional to the audio frequency. This results in a modulator output with a slightly rising frequency deviation at the higher audio frequencies. The rising characteristic is used to overcome the effects of noise.

e. Bias for the two modulator tubes is obtained from resistor R8, which is bypassed by C8. R15 and C12 form a decoupling network for the plate B+ supply. Resistors R11 and R12, bypassed by C10, are voltage-dropping resistors for the screens. Resistors R9 and R10, bypassed by C9, drop the pin 3 grid voltage for both tubes to the required value. C38 tunes the plate circuit to the crystal frequency. The modulator output is coupled to the first quadrupler stage by capacitor C11 which also keeps plate voltage from the grid of V4. The first quadrupler stage develops bias from grid leak resistors R13 and R14. R14, bypassed by C13, is also a shunt resistor in position 2 of the meter circuit when measuring grid current of the first quadrupler.

57. First and Second Quadruplers (figs. 42 and 43)

a. In order to increase the frequency deviation, the modulator output is fed into the two quadrupler stages. The output from the second quadrupler stage is 16 times the original crystal frequency, and the frequency deviation is 16 times the original frequency deviation. Both stages are identical schematically and functionally.

b. The output from the modulator stage is applied to the control grid of V4. The amplified signal is applied across a tuned plate circuit consisting of the primary of T3 which is resonated to four times the oscillator frequency by C39A. Coupling to the second quadrupler is effected through the secondary of T3 which is also resonated to four times the crystal frequency by C39B. This type of coupling increases the selectivity of the circuit. Plate voltage is applied through decoupling resistor R19, which is bypassed by C16. Screen voltage is applied

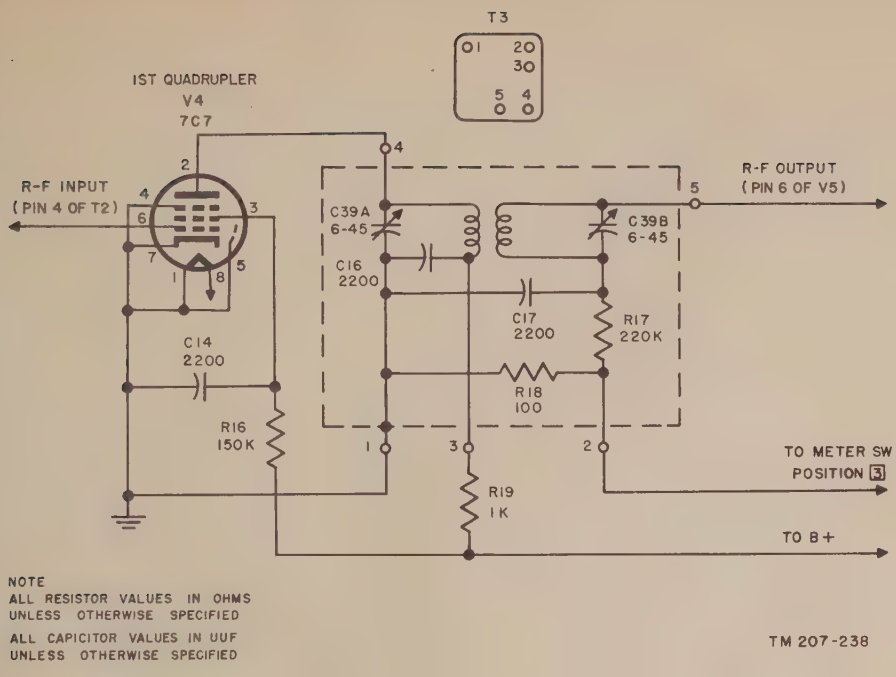


Figure 42. First quadrupler, functional diagram.

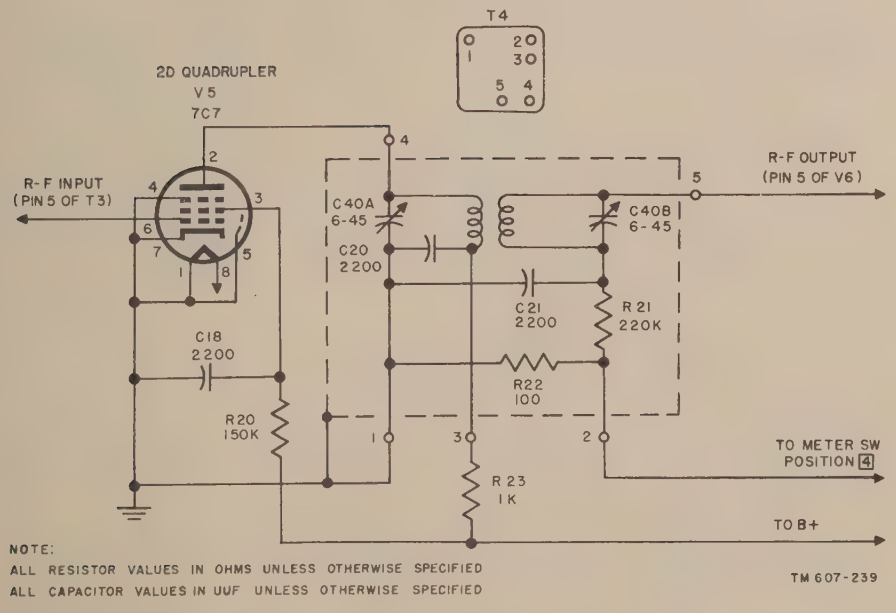


Figure 43. Second quadrupler, functional diagram.

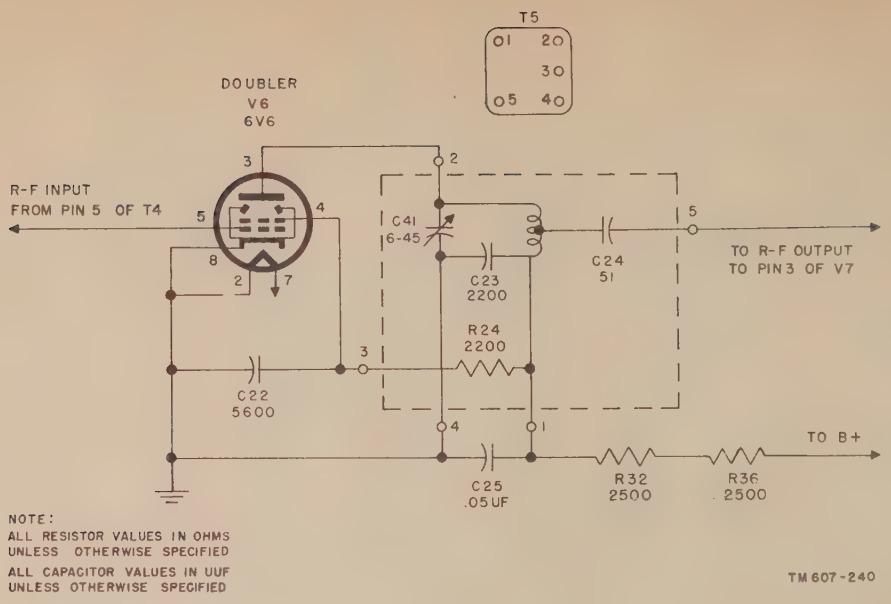


Figure 44. Doubler, functional diagram.

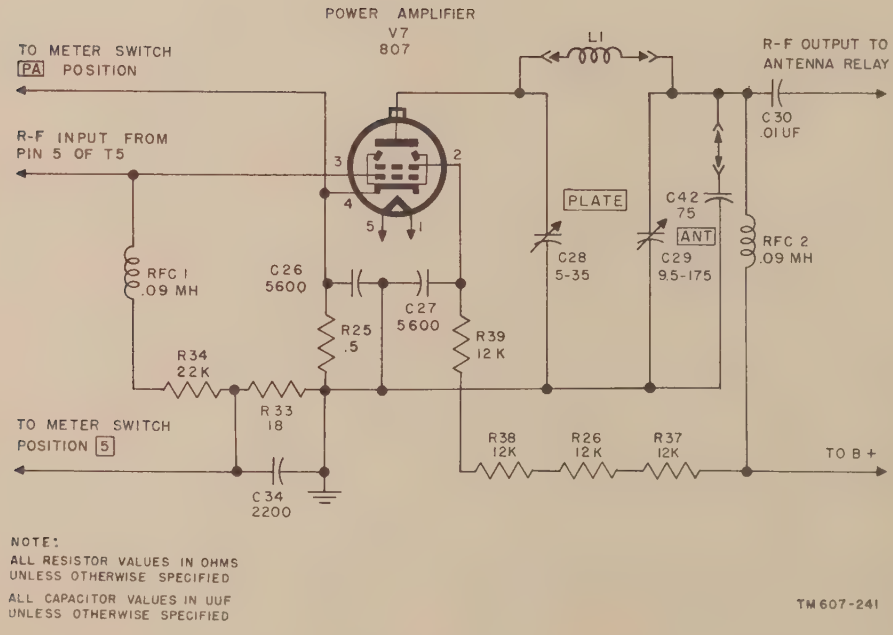


Figure 45. Power amplifier, functional diagram.

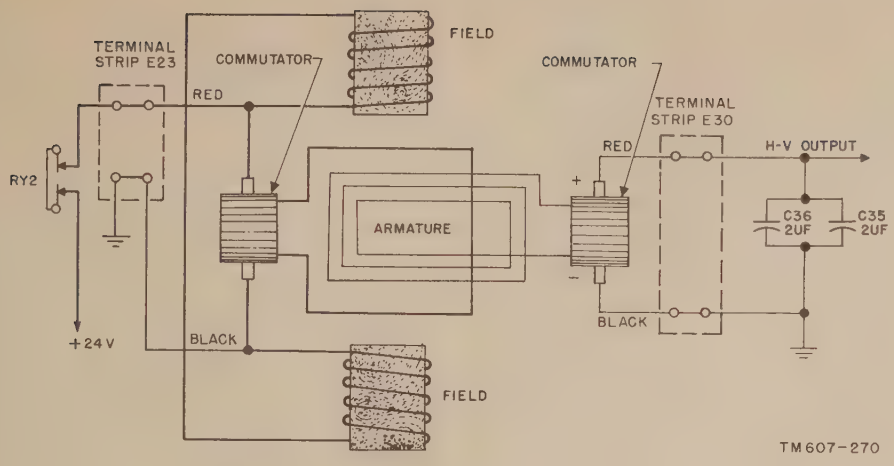


Figure 46. Transmitter power supply, functional diagram.

through dropping resistor R16, which is bypassed by C14. R17 and R18, in conjunction with C17, provide grid bias for the second quadrupler stage. R18 also serves as a meter shunt resistor when S1 is in the second quadrupler position (fig. 75).

c. The output signal from the first quadrupler is applied to the grid of V5. The amplified output of V5 is applied across the plate circuit consisting of the primary of T4 which is resonated to four times the frequency of the input signal by C40A. The secondary of T4 is resonated to the same frequency by C40B. Proper signal selection is thus obtained. R23 and C20 form a plate decoupling network. R20, bypassed by C18, is a dropping resistor for the screen voltage. R21 and R22 are bias resistors for the doubler stage. R22 is also a meter shunt resistor in position 4 of the meter circuit. C21 is the grid bypass for V6.

58. Doubler (fig. 44)

The frequency of the input signal applied to the doubler stage is 16 times the crystal frequency. V6 doubles this frequency and the resulting output is 32 times the crystal frequency. The plate circuit of the doubler stage is tuned to the correct frequency by C41. C23 is a plate circuit bypass capacitor. Screen voltage is applied through dropping resistor R24, which is bypassed by C22. R32, R36, and C25 form a decoupling network between the power amplifier stage and the other stages (fig. 75). C24 is the coupling capacitor to the final stage and also keeps the plate voltage from the grid of V7.

59. Power Amplifier (fig. 45)

a. The power amplifier stage operates as a conventional power amplifier and is used to raise the output of the transmitter to 30 watts. The output frequency is the same as the input frequency from the doubler stage.

b. The input from the doubler stage is applied to the grid of V7 and is amplified across the tuned circuit composed of L1 and variable capacitors C28 and C29. Grid leak bias is provided by R34, R33, and C24. R33, bypassed by C34, is also a meter shunt resistor in position 5 of the meter circuit. The r-f choke RFC1 in the grid circuit prevents r-f currents from entering grid resistors R33 and R34. Cathode current is measured by means of the voltage drop across R25, which is bypassed by C26. RFC2 prevents r-f currents from entering the h-v (high-voltage) supply. Screen voltage is applied through dropping resistors R37, R38, R39, and R26, which are bypassed to ground by C27. C30 is the output coupling capacitor.

60. Transmitter Power Supply (fig. 46)

a. A dynamotor power supply is used to provide the necessary h-v for the transmitter. The output is filtered by C35 and C36 to insure a pure d-c voltage.

b. The heavy lines in figure 46 indicate the l-v motor circuit. Current from the battery flows through the field coils and motor winding of the armature, setting up a magnetic field around both. Opposing polarities cause the armature to rotate. Since the armature and the field windings are in parallel, the armature speed remains fairly constant under varying load conditions. The h-v

winding, represented by the finer lines in figure 46, is also wound on the motor armature. When the motor armature rotates, the h-v windings which are on the same armature, cut the magnetic field and cause the h-v to be generated.

Section III. CONTROL HEAD AND CONTROL CIRCUITS

61. Control Head (fig. 47)

The control head contains all operating controls and indicating lamps required for Radio Set AN/VRC-2X. The VOLUME control serves as a power on-off switch and as a gain control in the grid circuit of V13. R1 is a dropping resistor for green lamp M2. R4 is the VOLUME control; it controls the output of the second a-f amplifier V13. R3 is the SQUELCH control; it is connected as a cathode resistor in noise amplifier tube V10 to serve as the noise amplifier gain control. R5 is a fixed cathode-biasing resistor for V10. R2 serves as a shunt across the speaker voice coil for better audio response in the speaker. Lamp M3 is energized when the push-to-talk switch in the microphone is depressed. It indicates that the transmitter is energized and the receiver plate voltage is off.

62. Contrrol Circuits

a. GENERAL. The function of energizing the receiver, de-energizing the receiver, and energizing the transmitter, and vice versa, is accomplished by the series-parallel arrangement of relays RY1, RY2, and RY3 (fig. 3). When the equipment is in a receiving condition, only RY1 is energized. When the operator presses the push-to-talk button on the microphone, RY2 and RY3 also are energized by completing their returns to ground.

b. RELAY RY1. Relay RY1 is energized when the VOLUME switch on the control head is closed. Operation of this switch and relay is shown in figure 3. The circuit may be traced in detail in figure 75. The specific path is as follows: From ground, battery current flows through the coil of RY1 to pin 3 of plug P1 and pin 3 of the transmitter control cable receptacle P11 (fig. 47), and through the cable to the terminal pin which plugs into pin jack 5 of the control head. From pin jack 5, current flows through the VOLUME control switch to pin jack 6, to the corresponding terminal pin of the transmitter control cable, through the cable to pin 1 of P11, and through pin 1 of P1, (fig. 75) to the four lugs of POWER plug P2. From P2, the relay current flows through battery cable receptacle P5, through the battery cable to plug 6, through fuse box E8 (fig. 18) to the battery and through the battery back to ground. When the coil of RY1 is energized, the core becomes a strong electromagnet and attracts the armature whose movement closes the contacts of the battery circuit to the transmitter filaments, receiver power supply, and the green lamp in the control head. RY1 is energized all the time that the equipment is in operation and closes the following circuits.

(1) *Transmitter filaments.* Current flows from ground through the two branches of the transmitter filament circuits (fig. 75), through FUSE F1, through the closed contacts of relay RY1, through POWER plug P2, through the battery cable and fuse box to the battery, and back to ground.

(2) *Receiver power supply.* Current for the receiver power supply flows from ground to pin 1 of vibrator E1 (fig. 37) through the coil of E1 to terminal 2 of E1, through terminal 3 of transformer T1, through one-half the primary of T1 to center tap terminal 2 of T1, and through filter choke L1 to FUSE F1. FUSE F1 also carries the filament currents of the receiver and power supply. Current flows from ground through three parallel branches of four filaments in series (fig. 74), and through another parallel branch consisting of the tube V13 filament with resistor R55 in parallel and thermal resistor R56 in series, to pin jack J2. Current for the rectifier filaments (fig. 37) flows from ground through the filaments of V1 and V2 to pin terminal P4, and then through pin jack J9 in the receiver (fig. 74) and thermal resistor R57 to J2. From J2, the combined current from the receiver and power supply filaments passes through terminal pin P3 (fig. 37) and filament filter choke L2 to FUSE F1. From FUSE F1, the total current from the receiver filaments, the power supply filaments, and the vibrator passes to pin 6 of CONTROL plug P1, through cable receptacle P28 of power interconnector cable W9, through the cable to cable terminating plug P27, and through pin 6 of RECEIVER receptacle J4 in the transmitter (fig. 75), to FUSE F1. The combined currents from the transmitter filaments and the receiver power supply pass through F1, through the closed contacts of RY1, through POWER plug P2, through battery cable receptacle P5, through the battery cable to plug P6, through fuse box E8 (Fuse Box J-498/VRC-2X) to the battery, and through the battery to ground.

(3) *Green lamp.* The green lamp on the control head (fig. 47) is lighted when the VOLUME switch is closed. Current flows from terminal 8 of P11 (grounded at the transmitter through pin 8 of P1) through the transmitter control cable to the pin terminal opposite pin jack 1, through pin jack 1, through green lamp M2, through resistor R1, and through the closed VOLUME

switch to pin jack 6. From pin jack 6, the lamp current flows through the corresponding pin terminal of the transmitter control cable, through the control cable to terminal 1 of P11, from P11 to CONTROL plug P1 (fig. 75) on the transmitter, from P1 to POWER plug P2, and through battery to ground as described in subparagraph (2) above.

c. RELAY RY2. Relay RY2 (fig. 3) is energized when the push-to-talk button on the microphone is depressed, and power is applied to the transmitter power supply, to the red lamp in the control head, and to the microphone. When the push-to-talk switch is closed, pins 3 and 4 of the microphone plug (fig. 47) are short-circuited. This closes the circuit between terminals 3 and 4 of microphone receptacle J1, between pin jacks 4 and 1, and between terminals 4 and 8 of P11. Terminals 4 and 8 of P11 are connected to pins 4 and 8 of plug P1 (fig. 75). Thus, pin 4 of P1 is grounded through pin 8 of P1 when the push-to-talk switch is closed. Now the circuit of relay RY2 can be traced. From pin 4 of P1 (ground), battery current flows through the coil of RY2, through FUSE F1, through the closed contacts of RY1, and through battery to ground as described in subparagraph *b* above.

(1) *Transmitter power supply.* When the coil of RY2 is energized by the current flowing through it, the armature contacts close the primary circuit of the dynamotor whose secondary output supplies plate voltage for the transmitter. The dynamotor circuit is shown in figure 46. Current flows from ground to terminal strip E23 and to the negative side of the low-voltage commutator, through the primary winding of the armature and through its parallel circuit, the field windings, to the positive side of the commutator, through the second terminal of E23, through the closed contacts of RY2 to the contacts of RY1, and through battery to ground as described in subparagraph *b* above.

(2) *Red lamp.* Red lamp M3 in the control head is lighted when the push-to-talk switch is closed. Lamp current flows from ground (pin 2 of P1, fig. 75) to terminal 2 of P11 (fig. 47), through the transmitter control cable to the terminal pin corresponding to pin jack 7, through pin jack 7 and red lamp M3 to pin jack 2, through the corresponding pin terminal of the transmitter control cable, through the cable to terminal 7 of P11, through pin 7 of P1, (fig. 75), through the closed contacts of RY2 and RY1, and back through the battery to ground as described in subparagraph *b* above.

(3) *Microphone.* The microphone circuit is energized by the closing of RY2. Current flow is from ground (pin 8 of P1, fig. 75) to pin 8 of P11 (fig. 47), through the transmitter control cable to pin jack 1 of the control head, through terminal 2 of microphone receptacle J1 to pin 2 of the microphone plug, through the microphone to pin 1 of the microphone plug, through pin 1 of the microphone receptacle J1 to pin jack 3, through the transmitter control cable to terminal 6 of P11, and through pin 6 of P1 (fig. 75) to terminal 1 of MIC jack J2. From terminal 1 of J2, the current flows to terminal 2 of microphone transformer T6, through the primary of T6 to terminal 1 of T6, through R31 to the power line junction, through the closed contacts of RY2 and RY1, and back through the battery to ground as described in subparagraph *b* above.

d. RELAY RY3. Relay RY3 operates at the same time as RY2. When the push-to-talk switch is closed, contacts 3 and 4 of the microphone plug close the circuit between terminals 3 and 4 of microphone receptacle J1 (fig. 47), between pin jacks 1 and 4, between terminals 4 and 8 of P11, and between pins 4 and 8 of P1 (fig. 75). When the circuit is closed between pins 4 and 8 of P1, battery current flows from ground through the coil of RY3, through FUSE F1, the closed contacts of RY1, POWER plug P2, battery cable receptacle P6, the battery cable, plug P5, fuse box E8, and through battery to ground.

(1) When RY3 is energized (shown in de-energized position in fig. 75), one set of contacts closes the circuit between the high-voltage output of the dynamotor and the plate circuits of the transmitter.

(2) A second set of contacts of the armature of RY3 is connected across terminals 3 and 4 of J4, which are in the B+ supply circuit to the receiver. When RY3 is energized, these contacts open and remove the high voltage from the receiver plate circuits.

(3) The third set of contacts of the armature of RY3 perform the double function of switching the antenna circuit from receiver to transmitter. When the receiver is being operated and RY3 is not energized, the armature contacts close the circuit between ANTENNA receptacle J3 and RECEIVER receptacle J5, which is connected to J6 in the receiver through the antenna interconnecting cable. When RY3 is energized, the armature contacts open the circuit between J3 and J5 and close the circuit between J3 and the transmitter power amplifier output.

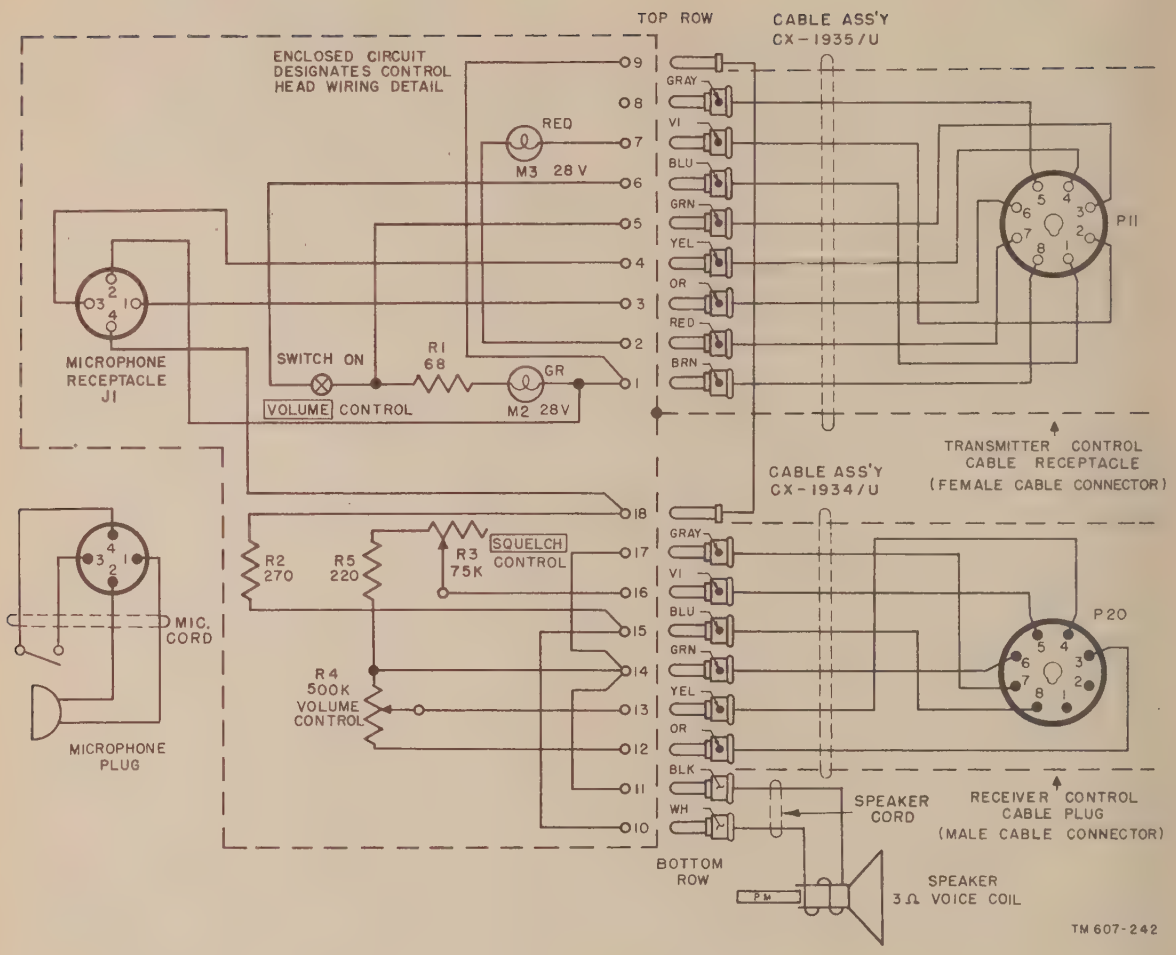


Figure 47. Radio Set Control C-1060/VRC-2X, schematic diagram.

63. Circuit Differences (figs. 48 and 49)

Radio Set AN/VRC-2X is similar to Radio Set AN/VRC-2 procured on Orders No. 20591-P-49 and 21756-P-50. Radio Set AN/VRC-2X operates from a 24-volt battery; Radio Set AN/VRC-2 operates from a 6-volt battery. Components of different value are used to accommodate this difference in input power. The major difference is in the filament circuits. Since the same tubes are used in both equipments, the filament circuits must be arranged differently. Figure 48 shows the receiver filament circuits of both sets, and figure 49 shows the transmitter filament circuits of both sets. In Radio Set AN/VRC-2, all the filaments are in parallel arrangement, and in Radio Set AN/VRC-2X, a series-parallel arrangement with additional components is necessary to achieve the proper filament voltage. Thermal resistors are used in the filament circuits of the power tubes of both the receiver and transmitter to drop the battery voltage and to function as constant current-type voltage regulators.

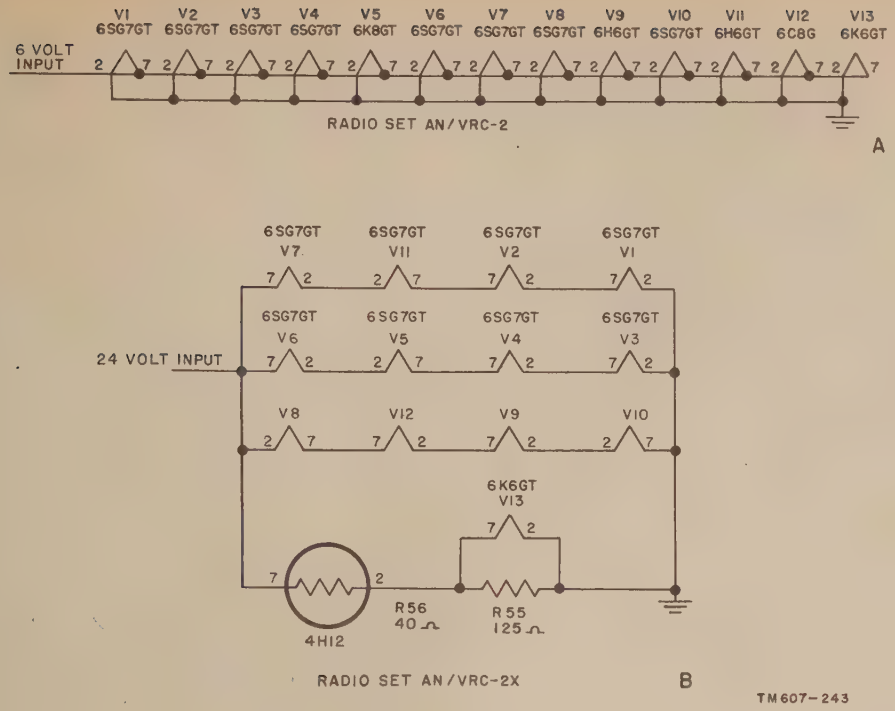


Figure 48. Radio Sets AN/VRC-2 and AN/VRC-2X, receiver filament circuits.

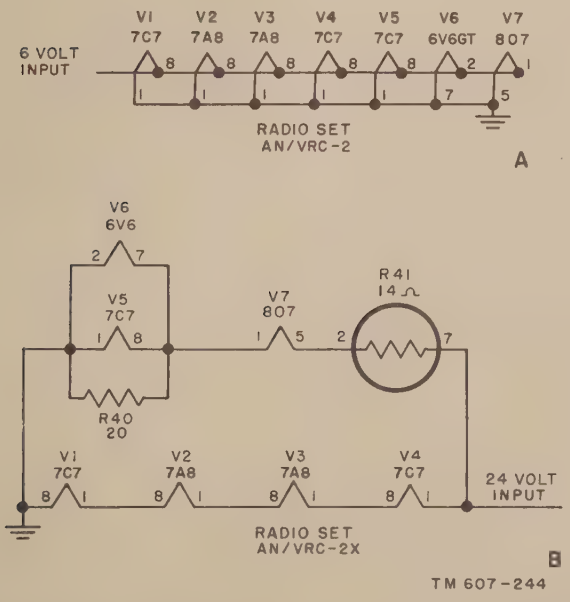


Figure 49. Radio Sets AN/VRC-2 and AN/VRC-2X, transmitter filament circuits.

CHAPTER 5
FIELD MAINTENANCE INSTRUCTIONS

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Section I. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Warning: When servicing the radio transmitter, be extremely careful because of the high voltages exposed. With the high voltage off, potentials as great as 600 volts may be present in the transmitter. Keep one hand in pocket when measuring socket voltages with the probe. Before touching any part after the voltage is shut off, short the part to ground.

64. Trouble-shooting Procedures

The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the *major component or circuit* responsible for the abnormal operation of the set. The second step is to localize the fault. Localization means tracing the fault to the defective *part* responsible for the abnormal condition. Some faults such as burned-out resistors, r-f arcing, and shorted transformers can often be located visually and aurally. The majority of faults, however, must be localized by *checking voltage and resistance.*

a. System Sectionalization. System sectionalization is discussed in paragraphs 36, 37, and 38.

b. Component Sectionalization. The tests listed below aid in isolating the source of trouble. To be effective the procedure should be followed in the order given. Remember that servicing procedure should cause no further damage to the receiver. First, trouble should be localized to a single stage or circuit. Then the trouble may be isolated within that stage or circuit by appropriate voltage, resistance, and continuity measurements. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection (par. 35) is to locate any visible trouble. Through this inspection alone, the repairman may frequently discover the trouble, or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the receiver which might occur through improper servicing methods and in forestalling future failures.

(2) *Input resistance measurements.* These measurements (par. 68) prevent further damage to the receiver from possible short circuits. Since this test gives an indication of the condition of the filter circuits, its function is more than preventive.

(3) *Operational test.* The operational test (par. 69) is important because it frequently indicates the general location of trouble. In many instances the information gained will determine the exact nature of the fault. In order to utilize this information fully, all symptoms must be interpreted in relation to one another.

(4) *Trouble-shooting charts.* The trouble symptoms listed in these charts (pars. 71 and 72) will aid greatly in localizing trouble.

(5) *Signal substitution.* The principal advantage of the signal substitution method (par. 73) is that it usually enables the repairman to localize a trouble accurately and quickly to a given stage when the general location of the trouble is not immediately evident from the above tests.

(6) *Intermittents.* In all these tests the possibility of intermittents should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the set. It is possible that the trouble is not in the receiver itself, but in the installation (mounting or vehicle), or the trouble may be caused by external conditions. In this event, test the installation if possible.

65. Trouble-shooting Data

Take advantage of the material supplied in this manual. It will help in the rapid location of faults. Consult the trouble-shooting data in the following charts.

a. Receiver.

Fig. No.	Description
37	Power Supply PP-721/VRC-2X, schematic diagram.
50	Tube socket voltage and resistance measurements.
51	Chassis, top view.
52	Chassis, bottom view.
53	Terminal strip TS1, front view, voltage and resistance measurements.
54	Terminal strip TS1, rear view, voltage and resistance measurements.
55	Power supply, bottom view.
56	Connectors, resistance measurements.
74	Complete schematic diagram.

b. TRANSMITTER.

Fig. No.	Description
57	Tube sockets, voltage and resistance measurements.
58	Chassis, top view.
59	Chassis, bottom view.
60	Terminal strip location.
61	Terminal strip TS1, voltage and resistance measurements.
62	Terminal strip TS2, voltage and resistance measurements.
63	Terminal strip TS3, voltage and resistance measurements.
64	Terminal strip TS4, voltage and resistance measurements.
65	Terminal strip TS5, rear, voltage and resistance measurements.
66	Terminal strip, TS5, front, voltage and resistance measurements.
67	Connectors, resistance measurements.
75	Complete schematic diagram.

c. RADIO SET CONTROL

Fig. No.	Description
47	Complete schematic diagram.
68	Rear connectors, resistance measurements.
69	Location of components.

66. Test Equipment Required for Trouble Shooting

Test equipment	Technical manual
Multimeter TS-352/U or equal	TM 11-5527
Signal Generator I-208-A, SG-12/U, or equal	TM 11-317
Signal Generator I-72, or equal	TM 11-307, TM 11-4052
Oscillator I-151, TS-382A/U, or equal	TM 11-2524
Tube Tester I-177, or equal	TM 11-2627
Oscilloscope BC-1060-A, or OS-8/U	TM 11-2526
Electronic Multimeter TS-505/U, or equal	TM 11-5511
Output Meter TS-585/U, or equal	TM 11-5017
34-ohm dummy antenna (2A271-11 or equiv.	
Frequency Meter TS-480/U, or equal	TM 11-5042
Microammeter, 0-50 ua range	

67. General Precautions

Whenever the transmitter is serviced, observe the following precautions very carefully:

a. To prevent overheating, do not allow the dynamotor to run more than 5 minutes out of every 10.

b. Be careful when the cover is removed; dangerous voltages are exposed.

c. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer, has a number of connections, tag each of the leads to it.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the set, since they may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to find.

(5) When a part is replaced in r-f or i-f circuits, it must be placed exactly as the original one was. A part which has the same electrical value but different physical size may cause trouble in h-f circuits. Give particular attention to proper grounding when replacing a part. Use the same ground as in the original wiring. Failure to observe these precautions may result in decreased gain or possibly in oscillation of the circuit.

68. Checking Key Circuits for Shorts (figs. 56, 67, and 68)

a. The purpose of the checks outlined in this paragraph is to make sure that when power is applied, the equipment will not be damaged because of short circuits. Also, many types of trouble, such as shorted capacitors, faulty relay contacts, faulty connectors, etc., may be discovered by means of these tests. Use Electronic Multimeter TS-505/U, or equivalent to check the readings given in figures 56, 67, and 68. For these measurements, all cables are disconnected.

b. If the required reading is not obtained, refer to the schematic diagram for the unit to determine which part or parts may be responsible for the trouble. Incorrect readings may be caused by shorted or leaky capacitors, defective relay contacts, defective resistors, wires shorted to the chassis, or a defective connection. Check

each capacitor in the affected circuit section for leakage or short, and replace if necessary. Check all connectors and controls. Repair if necessary. Do not operate the equipment until the proper readings are obtained.

69. Operational Test

a. If the readings given in the preceding paragraph are obtained, operate the equipment in order to locate the source of trouble. The operational checks serve as the first step in sectionalizing trouble. Before starting the operational check, make sure that the equipment is set up the way it is under normal operating conditions. Use either dummy antenna illustrated in figure 71 if convenient.

b. Operate the equipment as described in equipment performance checklist (par. 38). This checklist is important because it frequently indicates the general location of trouble and may save further trouble shooting if the corrective measures indicated are successful. Also, listen for crackling or buzzing noises which indicate h-v arcing. Check the equipment for smoke and odor of burned or overheated parts.

c. If the source of trouble still has not been located up to this point, trouble shooting is necessary. The first step is to trace the trouble to the faulty units. The following chart lists some of the various symptoms which may be recognized easily and gives the probable location of the existing trouble and the recommended correction. This chart will help the operator determine in what unit or stage the trouble is. By using the chart, the operator can isolate the trouble to one component of the equipment and thus save time that might otherwise be lost in checking normal components.

69*c* (contd)

Symptom	Probable trouble.	Correction
1. All controls in normal operating position. Green lamp does not operate. Transmitter and receiver do not operate.	1. Battery dead. Main fuse of fuse in transmitter open. Battery cable defective. Relay RY1 defective. Volume switch in control head defective. Transmitter control cable defective.	1. Replace battery. Replace fuses. Replace cable. Repair relay RY1. Repair switch. Repair cable.
2. Transmitter normal but receiver dead.	2. Power cable from transmitter open. Receiver power supply or fuse defective. Receiver defective.	2. Repair cable. Repair power supply. Repair receiver.
3. Receiver normal but transmitter dead.	3. Relay circuits RY2 and RY3 defective. Control head cable defective. Transmitter defective. Microphone switch defective.	3. Repair relay circuits. Repair cable. Repair transmitter. Replace microphone.
4. Receiver and transmitter normal but communication difficult.	4. Battery weak. Antenna poor. Location bad.	4. Recharge battery. Repair antenna. Change location.
5. Receiver normal but transmitter very weak.	5. Weak transmitter tubes. Transmitter misalined. Defective parts in transmitter.	5. Replace defective tubes. Retune transmitter. Replace defective parts.
6. Transmitter normal but receiver very weak.	6. Weak receiver tubes. Receiver misalined. Defective parts in receiver.	6. Replace defective tubes. Retune receiver. Replace defective parts.

Caution: Open fuses usually indicate that too much current is being drawn through the fused circuit. Do not replace the fuse until the source of trouble has been discovered. Refer to paragraph 68.

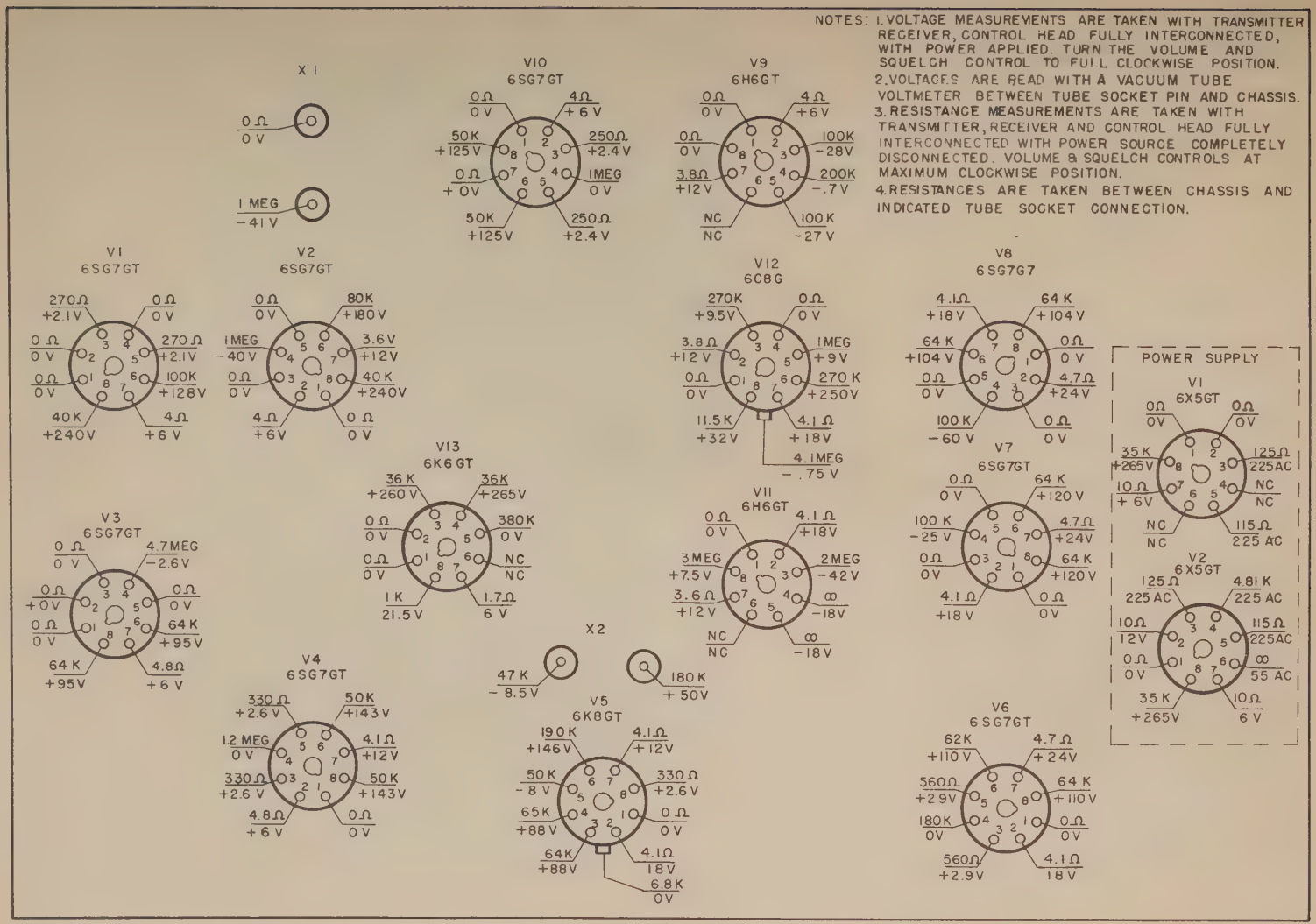


Figure 50. Receiver tube sockets, voltage and resistance measurements.

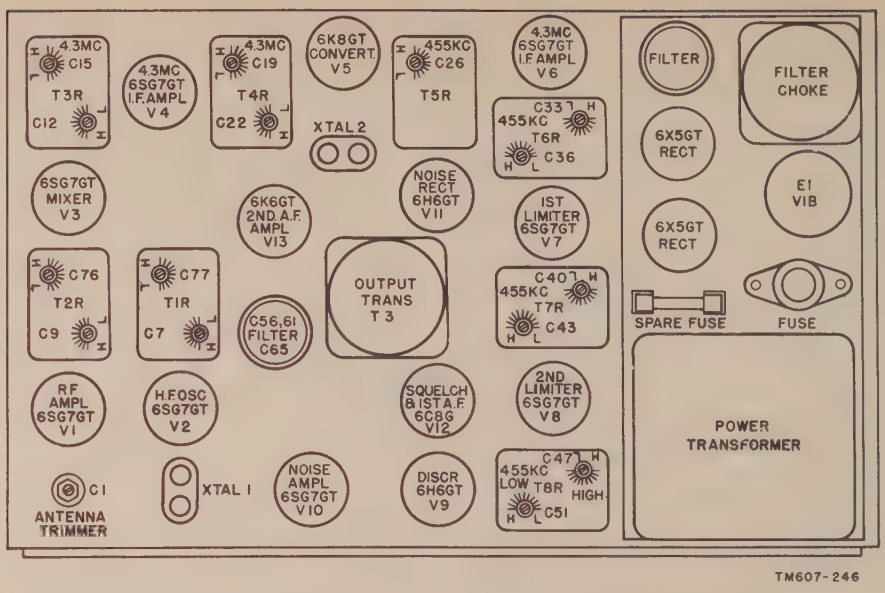


Figure 51. Receiver chassis, top view.

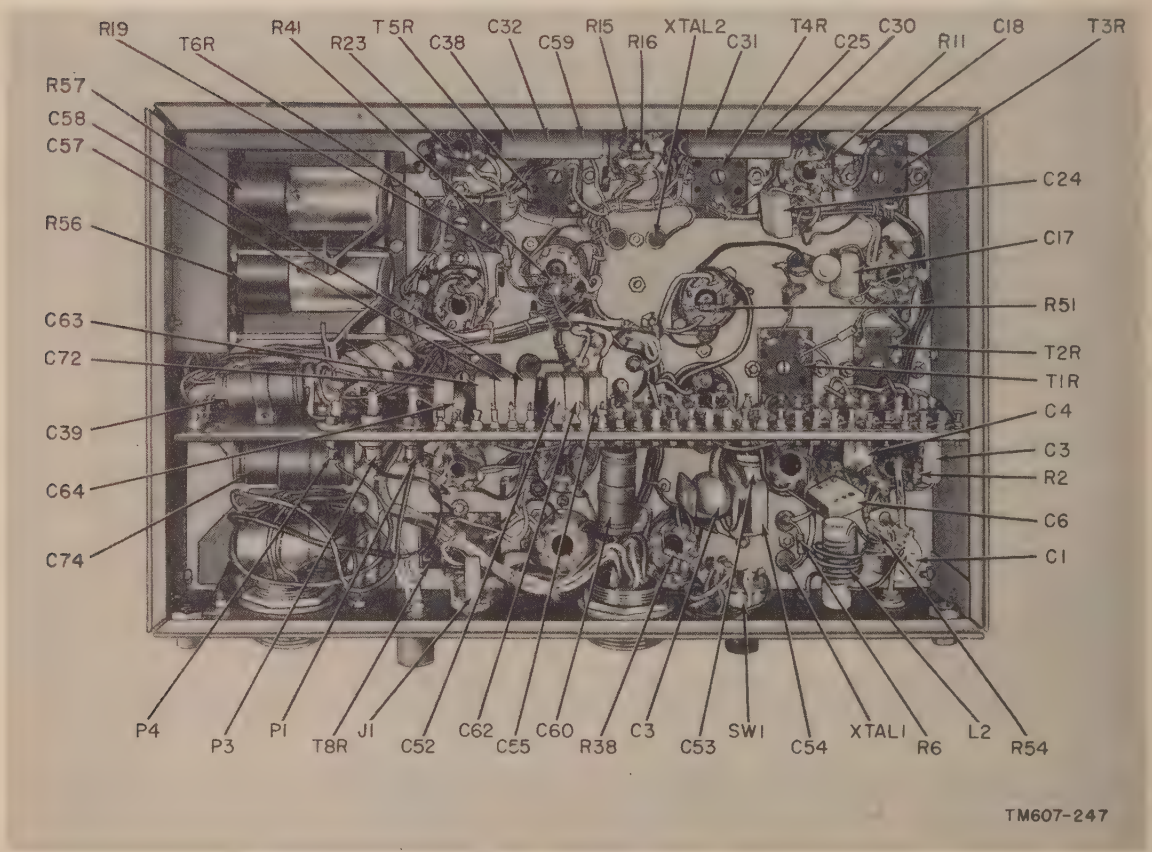
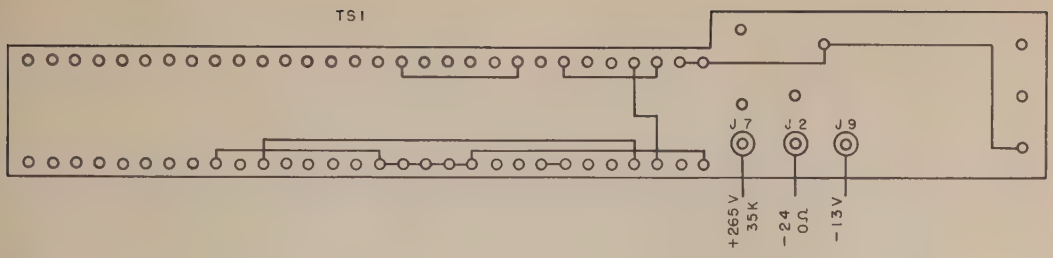


Figure 52. Receiver chassis, bottom view.

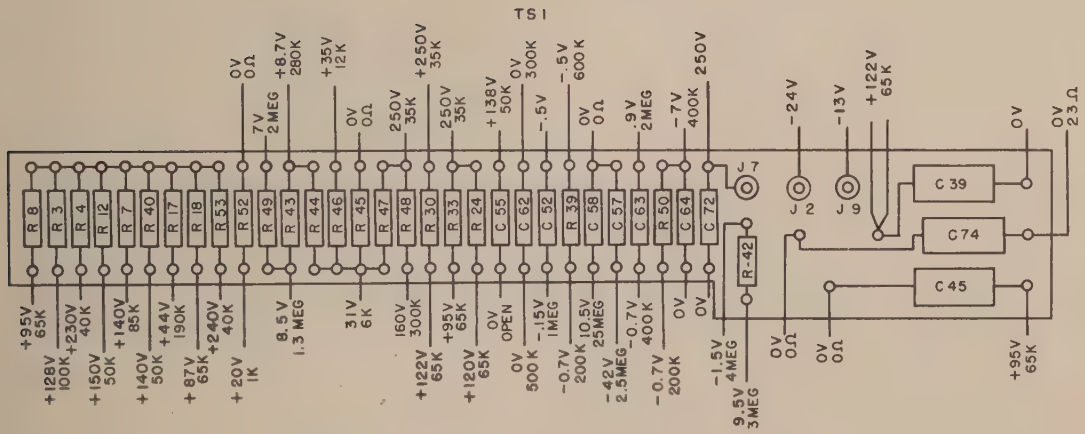


NOTES:

1. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A VACUUM TUBE VOLTMETER.
2. 24 VOLT INPUT TO 8 FOOT POWER CABLE
3. OUTPUT LOAD AT TRANSMITTER 34 OHMS.
4. SQUELCH CONTROL FULLY CLOCKWISE.

TM607-248

Figure 53. Receiver terminal strip, TS1, front view, voltage and resistance measurements.



NOTES:

1. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A VACUUM TUBE VOLTMETER.
2. 24 VOLT INPUT TO 8 FOOT POWER CABLE.
3. NO INPUT TO RECEIVER.
4. SQUELCH CONTROL FULLY CLOCKWISE.

TM607-249

Figure 54. Receiver terminal strip TS1, rear view, voltage and resistance measurements.

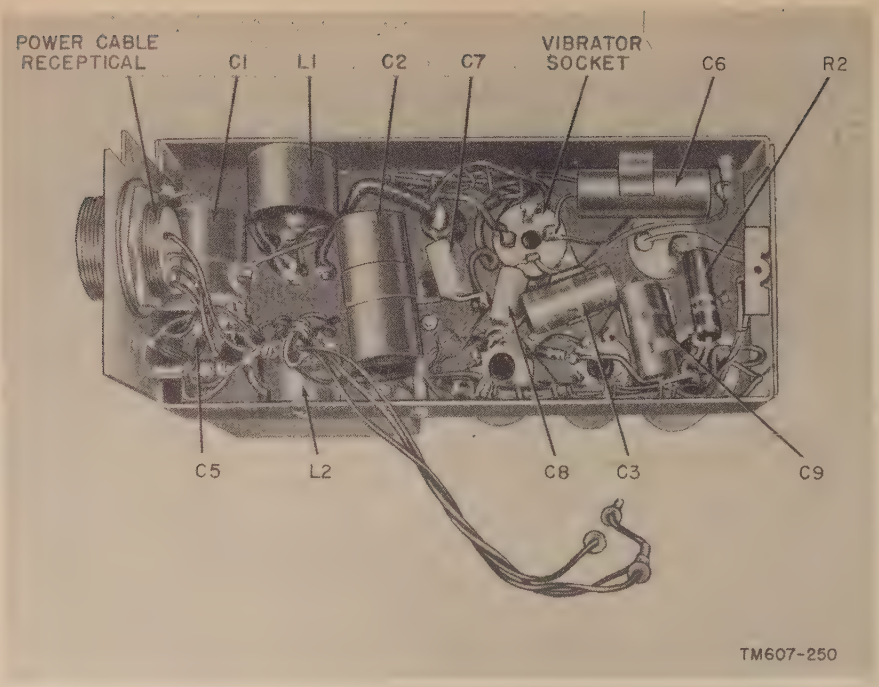


Figure 55. Receiver power supply, bottom view.

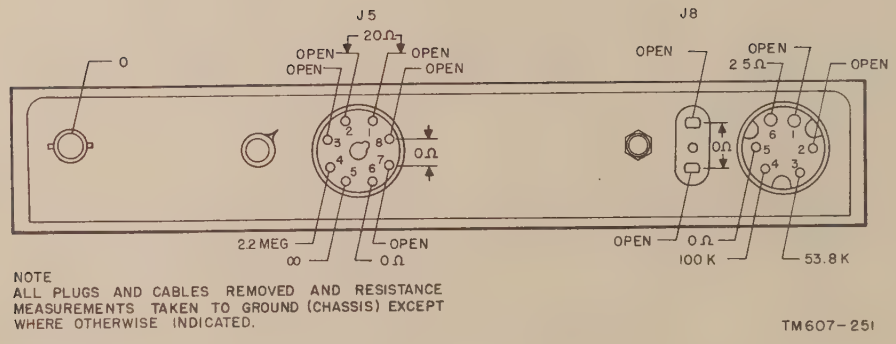


Figure 56. Receiver connectors, resistance measurements.

70. Localization

After the trouble has been sectionalized to the faulty unit, the next step is to localize the trouble to the defective stage and component. Since the equipment contains metering circuits for measuring voltages at various points, the localization process is simplified. The trouble-shooting charts for the transmitter and receiver make full use of these metering circuits. The required input signal and meter reading for each stage are given in the alinement section of the manual. If the set does not function properly, try to aline it according to the procedure outlined. Note where difficulties appear and refer to the trouble-shooting chart for the unit involved.

71. Trouble-shooting Chart for Receiver

Before attempting to do any trouble shooting, study all paragraphs which discuss the theory of operation of the receiver and its power supply. The following chart is supplied as an aid in locating trouble in the receiver and power supply unit. This chart lists symptoms which the repairman observes, either visually or audibly, while making a few simple tests. Once the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements of this stage or circuit should ordinarily be sufficient to isolate the defective part. Normal voltage and resistance measurements are given in figure 50. Before proceeding, make all corrections indicated in paragraph 69. The proper METER jack readings are found in paragraph 78. The readings are taken with a microammeter, of range 0-50 microamperes (3F891-29 or equivalent), connected as described in paragraph 78a.

71. Trouble-shooting Chart for Receiver (contd)

Symptom	Probable trouble	Correction
1. Filaments in receiver do not light. (Green lamp lights.)	1. Input source to power supply.	1. Check fuse in receiver power supply. Check power cable to receiver.
2. Receiver filaments light, no plate power.	2. Power supply or relay RY3.	2. Repair power supply. Repair relay circuit.
3. Some tube filaments do not light.	3. Defective tube.	3. Check filament circuits.
4. Low or no meter reading on position 5.	4. Tube V9 defective.	4. Replace tube V9. Repair or realine the preceding stages and discriminator transformer.
5. A 5-ua or greater meter reading on position 4.	5. Defective tube V9. Misalined discriminator.	5. Replace tube V9. Repair or realine discriminator transformer.
6. Low or no meter reading on position 3.	6. Defective tube V8. No output from the first limiter. Capacitor C44 shorted.	6. Replace tube V8. Repair and realine the preceding stages and transformer T7R. Replace capacitor C44.
7. Low or no meter reading on position 2.	7. Tube V7 defective. Capacitor C37 shorted. No output from 455-kc amplifier.	7. Replace tube V7. Replace capacitor C37. Repair or realine preceding stages and first limiter transformer T6R.
8. Low or no meter reading on position 1.	8. Tube V6 defective. Capacitor C29 shorted. No output from converter tube V5.	8. Replace tube V6. Replace capacitor C29. Repair or realine preceding stages.

72. Trouble-shooting Chart for Transmitter

Warning: Be extremely careful when making measurements since there are voltages in excess of 600 volts in the transmitter which are dangerous and can be fatal. Except for making voltage measurements, turn the power off when working in this unit.

Before attempting any trouble shooting, study the theory section dealing with the transmitter. Do not leave power on for more than a few seconds at a time. Use a microammeter to obtain the readings given in paragraph 79 of this manual.

72. Trouble-shooting Chart for Transmitter (contd)

Symptom	Probable trouble	Correction
1. Transmitter dead (no plate power).	1. Dynamotor defective. Capacitors C35 and C36 defective. Relays RY2 and RY3 defective. Microphone switch defective.	1. Repair dynamotors. Replace capacitors. Repair relay circuits. Repair microphone.
2. Only some filaments light.	2. Defective tube.	2. Check tubes in filament string.
3. Low or no reading on meter on PA position.	3. Defective tube V7. Power supply defective. Capacitors C27, C28, or C29 shorted. Antenna loading too light.	3. Replace tube V7. Repair power supply or replace rectifier tube. Replace capacitor. Retune or repair the antenna circuits.
4. Abnormally high meter reading on PA position.	4. No r-f from preceding stages. Plate circuit not tuned to the correct frequency. Grid circuit changed in value.	4. Repair or retune the preceding stages. Retune plate circuit Check grid circuit components.
5. Low or no meter reading on position 5.	5. No r-f excitation from preceding stages.	5. Repair or retune preceding stages. Replace capacitor C34.

72. Trouble-shooting Chart for Transmitter (contd)

Sympton	Probable trouble	Correction
6. Low or no meter reading on position 4.	6. Defective tube V6. Capacitor C21 shorted. No r-f excitation from preceding stages.	6. Replace tube V6. Replace capacitor C21. Repair or retune preceding stages.
7. Low or no meter reading on position 3.	7. Defective tube V5. Capacitor C17 shorted. No r-f excitation from preceding stages.	7. Replace tube V5. Replace capacitor C17. Repair or retune preceding stages.
8. Low or no meter reading on position 2.	8. Defective tube V4. Capacitor C13 shorted. No r-f excitation from preceding stages.	8. Replace tube V4. Replace capacitor C13. Repair or retune preceding stages.
9. Low or no meter reading on MOD. position.	9. Tube V2 or V3 or both defective. Capacitor C4 shorted. No r-f excitation from oscillator.	9. Replace tube V2 or V3 or both. Replace capacitor C4. Repair or retune oscillator stage.
10. Low or no meter reading on position 1.	10. Tube V1 defective. Capacitor C1 shorted. Crystal defective. Oscillator stage defective.	10. Replace tube V1. Replace capacitor C1. Replace crystal. Check the crystal and oscillator stage components.

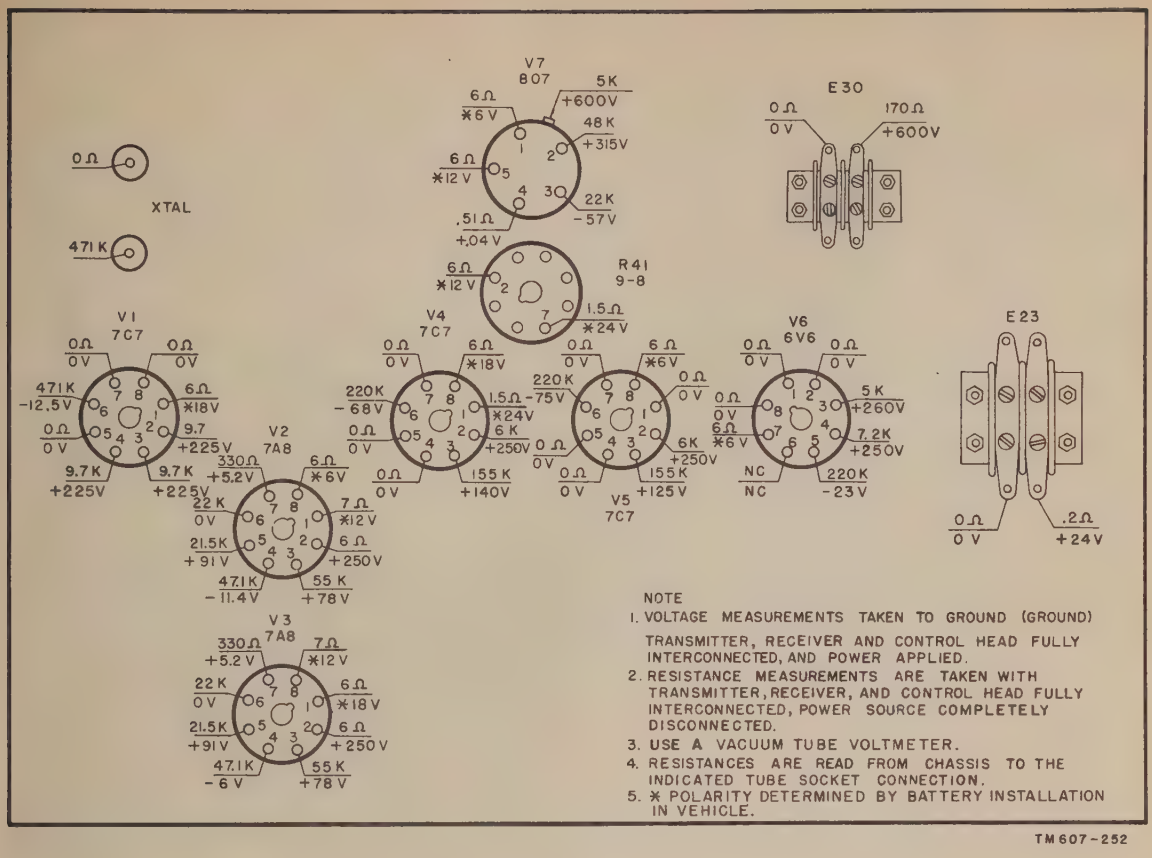


Figure 57. Transmitter tube sockets, voltage and resistance measurements.

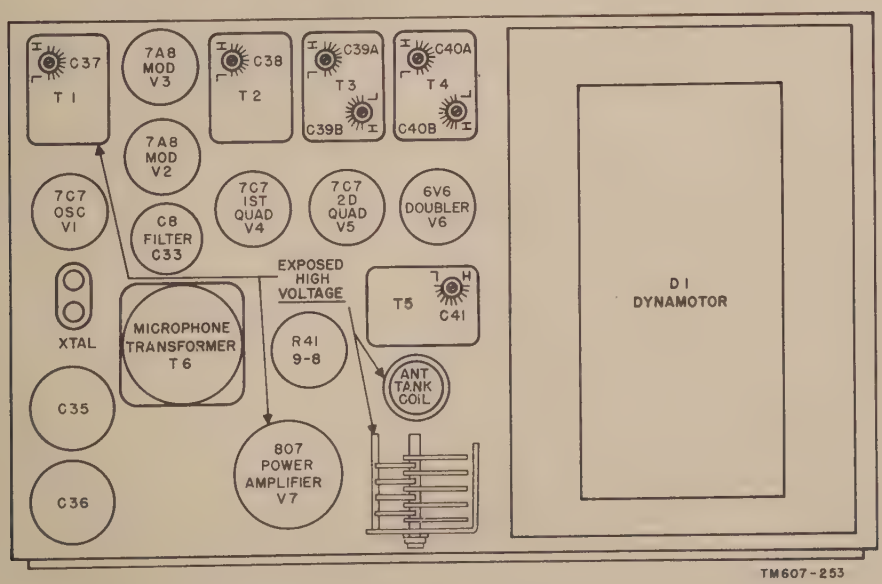


Figure 58. Transmitter chassis, top view.

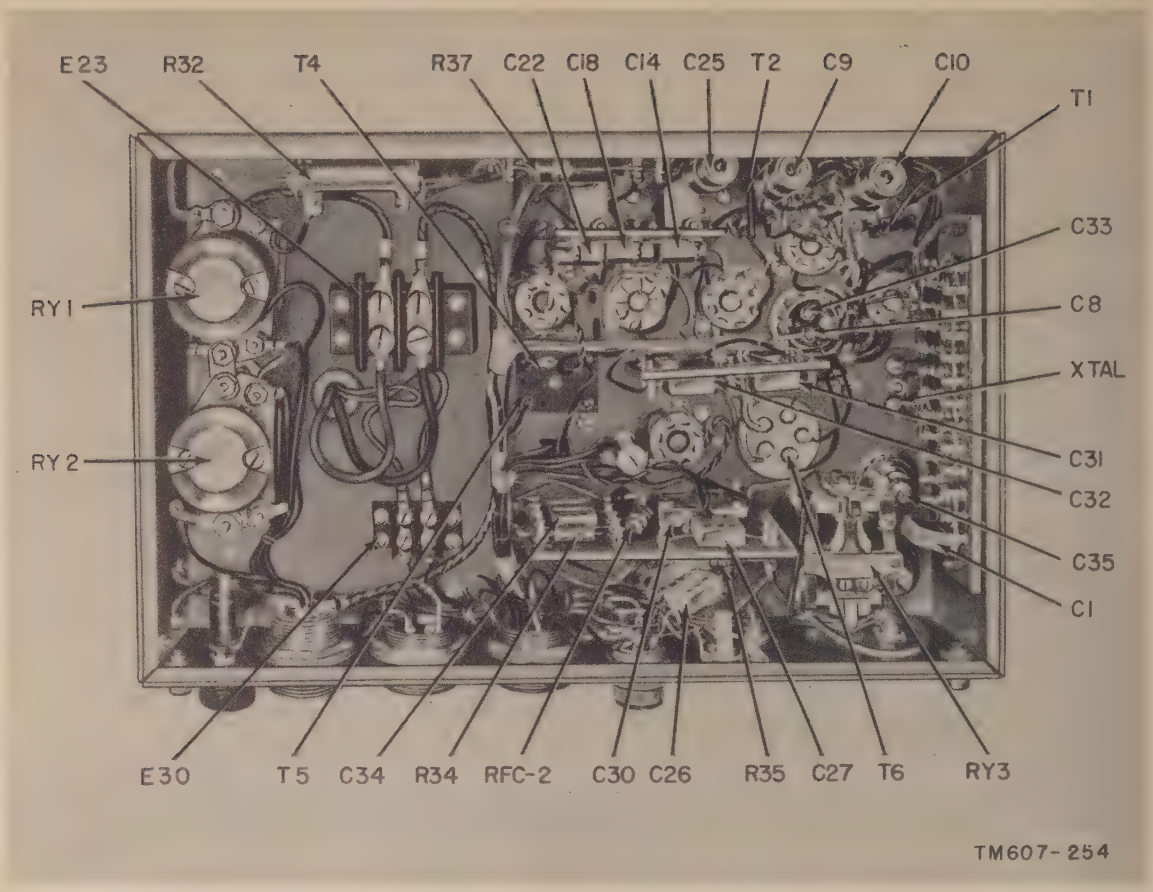


Figure 59. Transmitter chassis, bottom view.

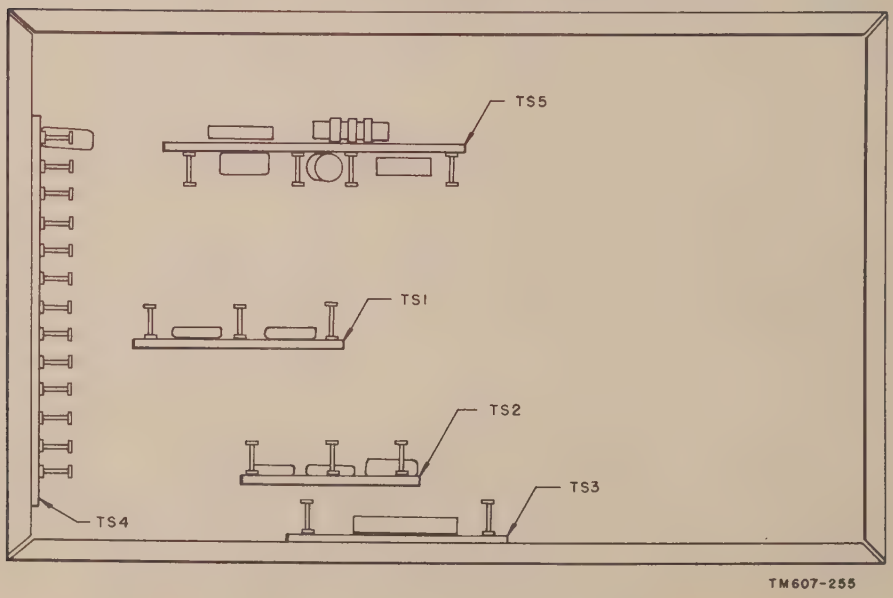
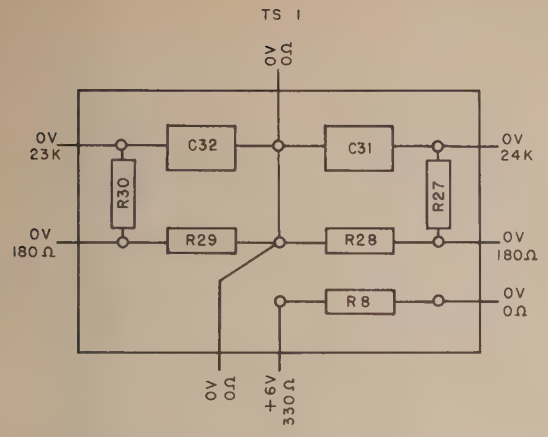


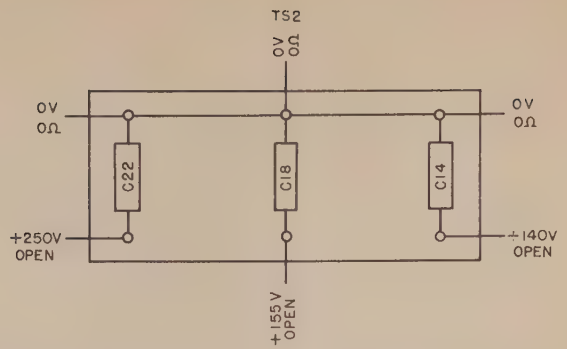
Figure 60. Transmitter terminal strip location.



NOTES:
1. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A VACUUM TUBE VOLTMETER.
2. 24 VOLT INPUT TO 8 FOOT POWER CABLE.
3. OUTPUT LOAD AT TRANSMITTER 34 OHMS.

TM 607-256

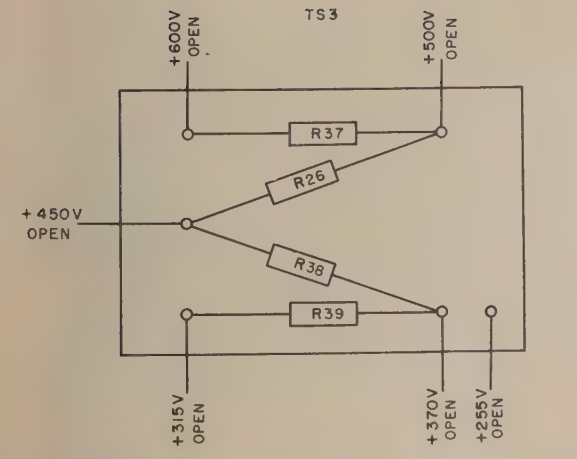
Figure 61. Transmitter terminal strip TS1, voltage and resistance measurements.



NOTES:
1. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A VACUUM TUBE VOLTMETER.
2. 24 VOLT INPUT TO 8 FOOT POWER CABLE.
3. OUTPUT LOAD AT TRANSMITTER 34 OHMS.

TM 607-257

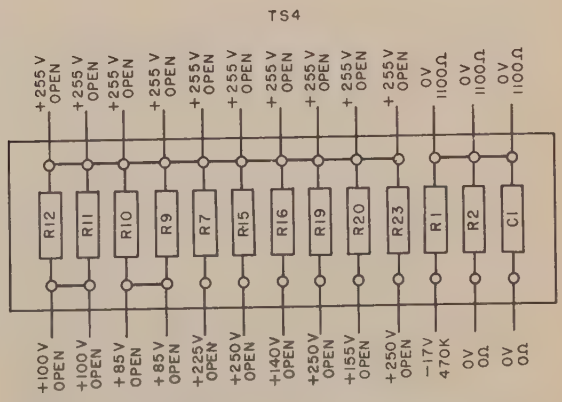
Figure 62. Transmitter terminal strip TS2, voltage and resistance measurements.



NOTES
1. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A VACUUM TUBE VOLTMETER.
2. 24 VOLT INPUT TO 8 FOOT POWER CABLE.
3. OUTPUT LOAD AT TRANSMITTER 34 OHMS.

TM 607-258

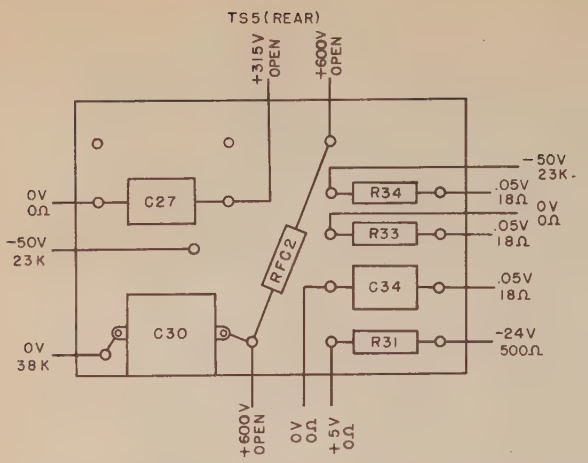
Figure 63. Transmitter terminal strip TS3, voltage and resistance measurements.



NOTES:
1. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A VACUUM TUBE VOLTMETER.
2. 24 VOLT INPUT TO 8 FOOT POWER CABLE.
3. OUTPUT LOAD AT TRANSMITTER 34 OHMS.

TM 607-259

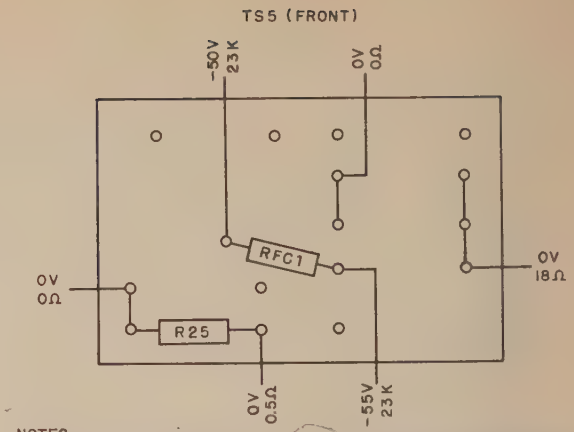
Figure 64. Transmitter terminal strip TS4, voltage and resistance measurements.



NOTES
1. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A VACUUM TUBE VOLTMETER.
2. 24 VOLT INPUT TO 8 FOOT POWER CABLE.
3. OUTPUT LOAD AT TRANSMITTER 34 OHMS.

TM 607-260

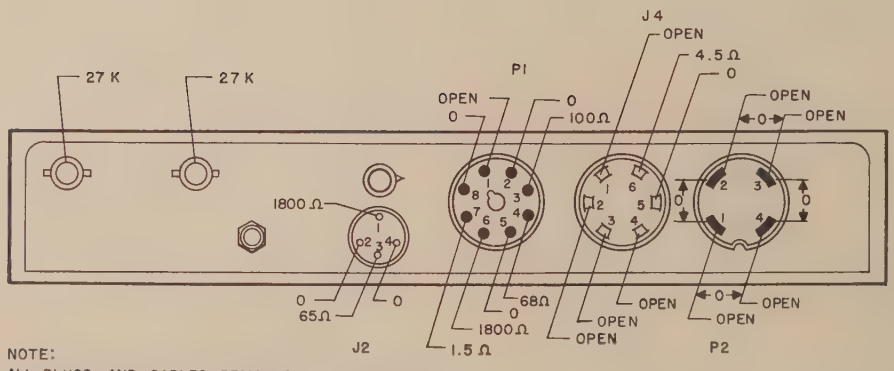
Figure 65. Transmitter terminal strip TS5, rear, voltage and resistance measurements.



NOTES
1. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A VACUUM TUBE VOLTMETER.
2. 24 VOLT INPUT TO 8 FOOT POWER CABLE.
3. OUTPUT LOAD AT TRANSMITTER 34 OHMS.

TM 607-261

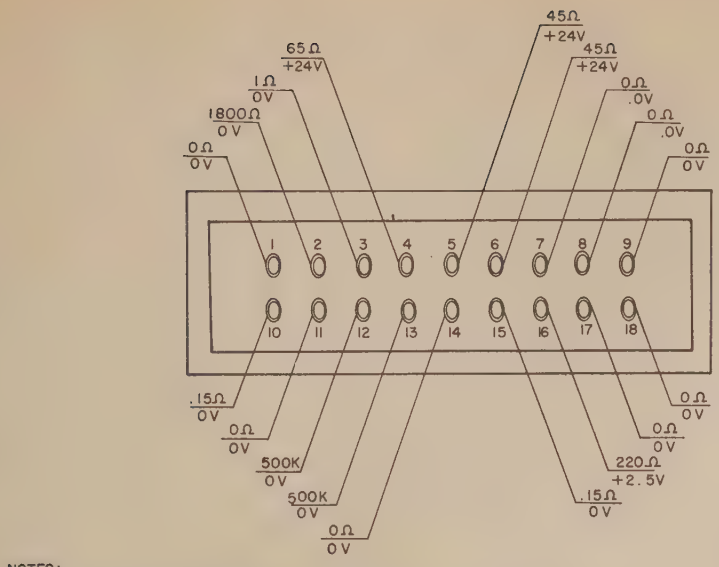
Figure 66. Transmitter, terminal strip TS5, front, voltage and resistance measurements.



NOTE:
ALL PLUGS AND CABLES REMOVED AND RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) EXCEPT WHERE OTHERWISE INDICATED.

TM 607-262

Figure 67. Transmitter connectors, resistance measurements.



NOTES:

ALL RESISTANCE READINGS TAKEN TO GROUND.
TRANSMITTER & RECEIVER FULLY CONNECTED BUT POWER REMOVED
SQUELCH & VOLUME CONTROLS FULL CLOCKWISE POSITION.

ALL VOLTAGE READINGS TAKEN TO GROUND
TRANSMITTER & RECEIVER FULLY CONNECTED TO POWER. (24 V DC)
SQUELCH & VOLUME CONTROLS FULL CLOCKWISE POSITION.

TM 607-263

Figure 68. Control head, rear, resistance measurements.

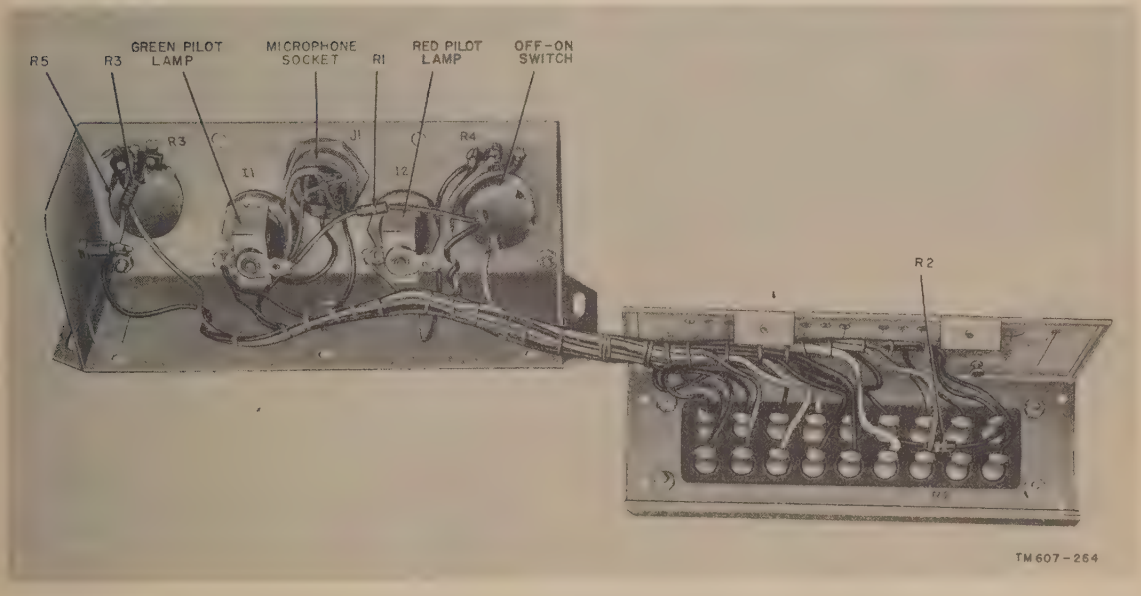


Figure 69. Control head, location of components.

73. Signal Substitution in the Receiver

Troubles not found by use of the trouble-shooting chart in paragraph 71 can be localized quickly by signal substitution. This method will indicate the defective stage quickly. In the tests indicated, ground one side of the signal generator to receiver chassis and connect the other side through a capacitor to the point indicated. When working back from the output to the input stages, decrease the output of the signal generator as much as possible. If possible compare with a receiver known to be in good condition. The equipment must be completely connected and the controls set in normal position. If distortion is present, check the tube, cathode resistor, and screen bypass in faulty circuit.

a. Inject a 400-cycle signal through a .01-uf capacitor into pin 5 of V13 and note if distortion is present. If no signal is heard or distortion is present, the condition is caused by faulty circuit components from V13 to the speaker. If distortion is present, inject the 400-cycle signal into pin 5 of V12 and note if distortion appears. Check components between the two stages if distortion appears now, or if no signal is heard.

b. Inject a 455-kc f-m modulated signal through a .001-uf capacitor onto the plate of the second limiter then work back to pin 4 of V8, pin 8 of V7, pin 4 of V7, pin 8 of V6, pin 4 of V6, and pin 3 of V5. Notice between what points the signal disappears or distortion is introduced. Check the components between these two points.

c. Inject a 4.3-mc f-m modulated signal through a .001-uf capacitor onto the cap of V5. Work back to pin 8 of V4, pin 4 of V4, pin 8 of V3 and pin 4 of V3. Notice between what points the signal disappears or distortion is introduced, and check the components involved.

d. Inject an f-m signal at the operating frequency into pin 4 of V3. Adjust slightly the frequency of this signal to obtain an output in the speaker. If the audio modulation or tone is heard, the h-f oscillator V2 is clear of trouble. If there is no output from the speaker, check the h-f oscillator stage V2.

e. Inject the f-m signal in turn on pin 8 of V1, pin 4 of V1, then through a .001-uf capacitor to pin 4 of V1, and then into the ANTENNA receptacle J6. Note between which points the signal disappears and check the components included.

Section II. REPAIRS

74. Replacement of Parts

Most of the parts in the equipment are accessible and can be replaced without special instructions if they are found faulty. However, observe the precautions given below:

a. Tagging Leads. Tagging leads is essential to assure that correct rewiring will be made when a part is replaced. Before unsoldering leads from transformers, tube sockets, panel connectors, or other parts, tie together the leads that are attached to each of these parts. With small tags or short pieces of adhesive tape, identify all wires in accordance with their numbered connections. Identify every lead that is to be removed.

b. Parts and Substitution. When damaged parts must be replaced, identical parts should be used. If identical parts are not available and the damaged component is beyond repair, a substitution must be made. The part substituted must have identical electrical properties and must be of equal or higher voltage and current rating.

c. Location. Relocation or substitution of parts may develop certain difficulties such as hum, noise, or crosstalk, and is not recommended.

d. Mounting. Mount the new or replaced part in the same mounting position as that formerly occupied by the damaged part. Fasten all mountings securely.

e. Soldering. Before soldering any connection, carefully scrape all parts that will be touched by the solder until all traces of rust, corrosion, and paint or varnish are removed. Dust the sprayed parts with a small clean brush. Clean all parts to be soldered. Wrap the wire around the solder lug so that it is mechanically secure. Use very little solder and sufficient heat to make the shielded leads; make sure that the shield is properly soldered to the ground lug. These instructions also apply to bonded connections between metal subassembly frames and the chassis plate. Make sure that the ground lug is securely bonded to the chassis. Be sure to clean away all particles or splashes of solder.

75. Dynamotor Inspection and Repair

Note. Refer to paragraph 31 for lubrication instructions.

a. Inspect brushes, brush assemblies, brush holders, and all miscellaneous parts after 50 hours of operation, as follows:

(1) Check and clean all accessible parts with a clean lint-free cloth.

(2) Inspect all machine screws and nuts on all supports or mounting brackets and see that they are all tight.

b. Inspect brushes for defects and length; see if they are broken, cracked, or chipped.

c. Inspect for loosely fastened or broken off brush shunts (pigtails).

d. Check for burned-off or broken strands (kinked, worn, or otherwise damaged); replace with complete brush assemblies obtained from spares.

Note. During replacement, comply with proper markings on brushes and brush holders (+ to +; — to —). This is done for quick and proper replacement, thereby eliminating a sand-in operation. No sanding should be necessary to obtain a good brush fit if it is replaced correctly.

e. Inspect brushes for length. Replace the brush if the brush spring extends less than ½-inch out of the holder when the brush is seated against the commutator.

f. Inspect both of the commutators for cleanliness, excessive wear, flats, or any unevenness. Replace a dynamotor having worn or otherwise damaged commutators with a new dynamotor.

g. Check bearings for loose shaft fit and defects such as binding or excessive wear as noted by wobble between the inner and outer races. DO NOT REMOVE BEARINGS FROM SHAFT. Replace a dynamotor having defective or worn bearings with a new dynamotor.

Note. The above operation is to be performed only by qualified personnel.

76. Refinishing

Instructions for refinishing badly marred panels on exterior cabinets are given in TM 9-2851. Also refer to paragraphs 32 and 33 of this manual.

Section III. ALINEMENT PROCEDURES

77. Test Equipment Required

Test equipment required for the alinement of the equipment is the same as that listed in paragraph 66.

Note. Use Alignment Tool TL-207 in making all the adjustments indicated.

78. Receiver Alinement

a. General. (1) The METER jack and METER SWITCH provided on the receiver panel (figs. 20 and 74) facilitate a rapid alinement check of each circuit having a METER SWITCH position. Readings are taken by connecting a microammeter to the METER jack by means of a Plug PL-55 or any standard phone plug. The negative terminal of the meter must be connected to the sleeve (ground) of the plug, and the positive terminal must be connected to the tip of the plug. A meter centered at zero may be used, and it should be kept in mind that all meter readings are negative. The following typical readings at the METER jack for alinement of the receiver are taken with 1,000 microvolts of unmodulated carrier frequency applied to the receiver ANTENNA receptacle J6.

78*a*(1) (contd)

Meter switch position	Circuit	Alinement control	Typical Meter reading (ua) (microamp)
1	455-kc i-f amplifier grid current.	T5R	—25
2	First limiter grid current.	T6R	—35
3	Second limiter grid current.	T7R	—44
4	Resultant discriminator load current.	T8R	0
5	Diode resistor R36 current.	T8R	—26

Note. Slight deviations from these figures are permissible. However, any deviation of more than 25 percent should be considered as sufficient cause for realinement or possible tube replacement.

(2) Before beginning the actual alinement procedure, set the trimmers to their approximate position using figure 70 as a guide. Select the proper crystals by referring to paragraph 39. When adjusting double-tuned transformers, the primary is adjusted for maximum reading and then the reading is increased by tuning the secondary. Finally, the primary is tuned for a greater reading, if possible.

b. 455-KC Amplifiers and Limiters. Using a .05-uf capacitor in series with source, and a 1-megohm resistor from grid cap to ground, apply a 455-kc signal to the grid cap of V5. Set the METER SWITCH to position 2 and with Alignment Tool TL-207 adjust T5R and T6R for maximum meter deflection. Set the METER SWITCH to position 3 and tune T7R for maximum deflection of the meter. Repeat the tuning procedure outlined above, decreasing the generator output as required to insure sharp tuning at the peaks. An input signal of approximately 1,000 microvolts should indicate a reading of 27 microamperes at position 2 and 37 microamperes at position 3.

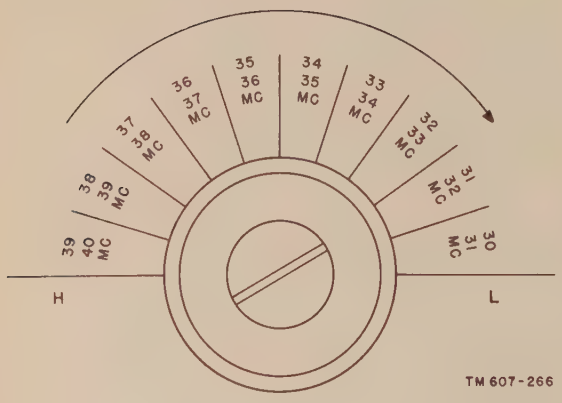


Figure 70. Details of trimmer adjustments.

c. Discriminator Alinement Procedure. (1) Connect a signal generator (through a .01-uf capacitor) to the grid cap of tube V5. Insert a 1-megohm resistor between grid cap and ground. Adjust to the following settings:

(a) Input signal level 30,000 microvolts.

(b) High- and low-frequency trimmers C47 and C51 to mark "H".

(2) Rotate the meter switch knob to position 5. Set the signal generator to 430 KC and adjust low-frequency trimmer (farthest from the power supply) to a maximum reading on the microammeter.

(3) Rotate meter switch knob to position 4. Reverse meter polarity; then set the signal generator on 480 KC. Adjust the h-f trimmer (closest to the power supply) for a peak reading. This reading should indicate a value in excess of 35 microamperes.

(4) Repeat step 2; this reading should indicate a value in excess of 35 microamperes.

(5) Reset the meter switch to position 4. Adjust signal generator to 455 KC. If the meter indication is positive, turn the low-frequency trimmer towards mark "H" until the microammeter indicates zero. If the meter indication is negative, turn the high-frequency trimmer towards mark "L" until the microammeter indicates zero. A tolerance of ±4 ua is permitted for correct alinement.

(6) The discriminator alinement is checked as follows:

(a) Rotate meter switch knob to position 4.

(b) Adjust signal generator to 440 KC.

(c) Meter reading should indicate a value in excess of 25 microamperes of negative polarity.

(d) Readjust signal generator to 470 KC.

(e) Meter reading should indicate a value in excess of 25 microamperes of positive polarity.

(f) Absolute reading indicated in subparagraph *(c)* above should be within 10 microamperes of the absolute reading indicated in subparagraph *(d)* above.

d. 4.3-MC I-F Amplifier. Set the METER SWITCH to position 2. Remove high-frequency oscillator crystal. Apply a 4.3 mc-signal, through a .05-uf capacitor, to pin 4 of V3. Adjust the signal generator frequency for maximum reading of the meter. This compensates for minor discrepancies in the crystal frequency of XTAL 2. Adjust T3R and T4R for maximum meter deflection. An input signal of 10k microvolts should indicate 25 microamperes.

e. R-F Circuits. Replace h-f oscillator crystal. Set the METER SWITCH to position 2. Connect the h-f generator directly to the ANTENNA receptacle, J6. Make the leads as short as possible and be sure that the cable shield is grounded to the chassis. With the signal generator set at the approximate operating frequency, readjust the generator for maximum meter reading. Tune T1R, T2R, and C1 for maximum reading. As tuning progresses, decrease the output of the signal generator until the final adjustment is made with a signal input of less than 1 microvolt. False alinement, tuning to a harmonic of the oscillator, is shown by a steady meter reading which does not decrease as the input signal is decreased. Realinement of r-f section is necessary.

f. Over-all Check. Typical meter readings for a properly alined receiver are given in subparagraph *a* above.

79. Transmitter Alinement

Caution: High voltages are present in the transmitter; be careful during the alinement procedure.

a. Preliminary Procedure. Before beginning the actual alinement of the transmitter, perform the following preliminary procedures.

(1) Select the proper crystal and tank coil by referring to the information in paragraph 39. If the operating frequency lies between the 30 and 33 mc, connect capacitor C2 across terminals 4 and 5 of T1.

(2) Connect a dummy antenna (two are shown in fig. 71) to the transmitter at the ANTENNA receptacle J3. Make the leads as short as possible.

(3) Set all transformer adjustments to the proper frequency. Refer to figure 70.

(4) Plug a microammeter into METER jack J1 with meter terminals connected as described in paragraph 78*a*.

Note. When tuning double-tuned transformers, adjust the primary for maximum meter readings; after adjusting secondary for peak, the primary is retuned for maximum. Use Alignment Tool TL-207 for all alinement adjustments.

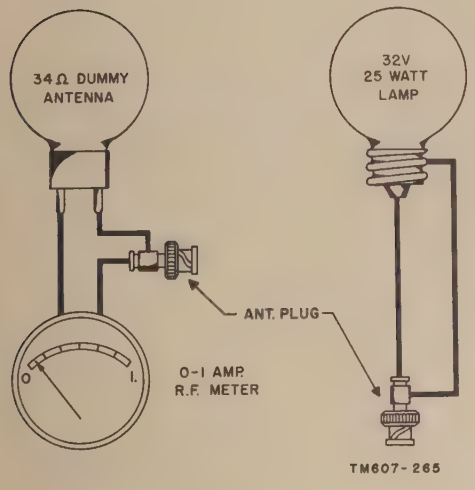


Figure 71. Dummy antennas.

b. OSCILLATOR. Set the METER SWITCH to position 1. Depress the push-to-talk button on the microphone. (Do not depress the switch for more than 2 or 3 seconds at a time.) Tune C37 for maximum reading. Rotate control slightly counterclockwise from peak reading position to assure more stable operation. Normal reading in position 1 is 45 microamperes. As a further check, turn METER SWITCH to MODULATOR position. The meter reading should be approximately 23 ua.

c. MODULATOR. Set the METER SWITCH to position 2. Adjust C38 for maximum meter reading. The meter should read 14 microamperes.

d. FIRST QUADRUPLER. Set the METER SWITCH to position 3. Tune T3 for maximum meter reading. The slot in the tuning shaft should point approximately to the carrier frequency (fig. 70). Normal meter reading in position 3 is 30 microamperes.

e. SECOND QUADRUPLER. Turn the METER SWITCH to position 4. Adjust T4 for maximum meter reading. Slot in tuning shaft should point approximately to the carrier frequency. The meter should read 18 microamperes.

f. DOUBLER. Set the METER SWITCH to position 5. Adjust T5 for maximum meter reading. A peak reading of 27 microamperes should be obtained.

g. POWER AMPLIFIER. Set the METER SWITCH to PA position. Reverse the meter leads. Before applying plate voltage, set ANTENNA capacitor C29 fully counter-clockwise to maximum capacitance. Operate the press-to-talk button and adjust PLATE capacitor C28 for minimum meter reading. Reduce the value of C29 slightly and readjust C28 for minimum reading. Continue this adjustment until the meter reads 33 microamperes at the dip obtained by rotating the PLATE capacitor.

h. TYPICAL TRANSMITTER ALINEMENT READINGS.

Meter switch position	Circuit	Alinement control	Typical Meter reading (ua)	Allowable Limits of Meter reading (ua)
1	Oscillator grid current.	T1	—20	—11 min.
2	First quadrupler grid current.	T2	—30	—12 min.
3	Second quadrupler grid current.	T3	30	—12 min.
4	Doubler grid current.	T4	—20	—6 min.
5	Power-amplifier grid current.	T5	—33	—12 min.
PA	Power-amplifier cathode current.	PLATE	40	42 max.
MOD.	Modulator grid current.	T1	—45	—15 min.

Section IV. FINAL TESTING

80. General

This section is intended as a guide to be used in determining the quality of a repaired Radio Set AN/VRC-2X. The minimum test requirements outlined in paragraph 82 through 89 may be performed by maintenance personnel with adequate test equipment and necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

81. Test Equipment Required for Final Testing

The instruments needed for testing the repaired equipment are listed below:

Signal Generator I-208-A or SG-12/U with metered output covering the range of frequencies. The generator should have provision for an independent a-f output at audio frequencies ranging from 500 to 2,500 cycles. If the generator does not possess independent a-f capabilities, a separate a-f generator may be used to furnish a-f signals.
Electronic voltmeter (Electronic Multimeter TS-505/U or equal).
Distortion meter (TS-705/U, TS-723/U, or equal).
Dummy antenna (34-ohm).
1.5-ampere r-f meter.
Output Meter TS-585/U or equal.
Deviation meter, if available.
Standard phone plug, with leads (type PL-55).
Micrometer, range 0-50 ua (3F891-29 or equal).

82. Preparation

a. Insert the cable plugs into proper receptacles.

b. Connect Signal Generator I-208 to receiver ANTENNA connector through a 34-ohm resistor.

c. Connect Electronic Multimeter TS-505/U across the 600-ohm output winding of the output transformer.

d. Insert a 7675-kc crystal in the receiver h-f crystal socket.

e. Apply power.

f. Set METER SWITCH to position 2.

g. Feed in 1,000 microvolts of unmodulated carrier frequency (35 mcs).

h. Tune T3R, T4R, C1, T1R, and T2R, in that order, for maximum meter reading. Since the first limiter grid saturates at about 30 microamperes, the signal generator output should be decreased as the set is being tuned, and the meter reading reaches this point.

i. When the trimmers are finally tuned, carefully readjust the signal frequency until meter position 4, the output of the discriminator, reads zero.

Note. Frequency specified in subparagraph *g* is midrange of the set.

83. Sensitivity

a. Adjust the signal frequency to produce zero balance as in paragraph 82*i*.

b. Reduce the signal generator output to zero by pulling the attenuator all the way out.

c. Set the squelch control so that noise is heard.

d. Raise the noise volume to a convenient level, preferably about 1 to 5 volts. Note the db (decibel) level on the multimeter.

e. Increase the signal generator output from zero until the noise level will have decreased 20 db (or one-tenth of the noise level voltage). The signal voltage required to produce 20 db quieting shall not exceed 1.0 microvolt.

84. Minimum Squelch

a. Adjust the signal frequency to produce zero balance as in paragraph 82*i*.

b. Reduce the signal generator output to zero.

c. Adjust the squelch control until the silencing action just begins and no noise is heard in the speaker. The signal voltage required to remove the silencing action shall not exceed .18 microvolt.

85. Maximum Squelch

a. Adjust the signal generator to produce zero balance as in paragraph 82.

b. Reduce the signal generator output to zero.

c. Set the squelch control to the fully counterclockwise position.

d. Increase the signal magnitude until the silencing action begins. The signal required to do so should not exceed 2.0 microvolts.

86. Audio Distortion

a. Adjust the signal generator to produce zero balance as in paragraph 82.

b. Set the signal input at 10 microvolts, and modulate it at 1,000 cps to produce 15-kc deviation.

c. Disconnect the speaker.

d. Adjust VOLUME control to produce an audio power output of 1 watt (24 volts).

e. Connect a distortion meter (Spectrum Analyzer TS-723/U) across the 600-ohm output circuit and take a reading.

f. The percentage of distortion should not exceed 12 percent.

87. I-f Bandwidth

Feed a 4.3-mc signal directly into the first mixer grid, pin 4 of V3. Set the signal output to approximately 10 microvolts and the frequency to give maximum meter indication in position 2. Readjust the signal amplitude to give a convenient reading below 30 microamperes. The signal amplitude shall be doubled, and the signal frequency varied to both sides of the frequency which gave maximum meter indication, until the meter reading is the same as the initial setting. The bandwidth at 2 times down (6 db) should be 18 kc or more. The above procedure must be repeated, except that signal magnitude should be increased by 1,000 times (60 db), and the bandwidth so obtained must not exceed 107 kc.

88. Power Output

Using a dummy antenna (fig. 71) consisting of a 34-ohm, 100-watt, noninductive resistor in series with a 1.5-ampere r-f meter, measure the power output of the properly alined transmitter. The meter reading should not be less than .9 ampere.

89. Modulation Sensitivity

a. Feed a .1-volt, 3,500-cycle sine wave into the transmitter MIC jack, and measure the carrier deviation with a deviation meter connected. The carrier deviation should be 15 kc from the nominal carrier frequency.

b. If a deviation meter is not available, the deviation may be determined by measurement of the discriminator a-c voltage output of a properly calibrated f-m receiver. The receiver may be calibrated by applying the output of an f-m signal generator to the receiver and noting the magnitude of the discriminator a-c output voltage for specific settings of the deviation control on the signal generator. With the signal generator removed and the calibrated receiver tuned to the transmitter, the value of the discriminator a-c output voltage then can be used to determine the deviation of the transmitter signal.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

90. Repacking for Shipment or Limited Storage

a. The exact procedure in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Refer to paragraph 13 and reverse the instructions given.

b. Whenever practicable, place a dehydrating agent such as silica gel inside the chests. Protect the chests with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected chests in a padded wood case, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

91. Demolition of Materiel to Prevent Enemy Use

The demolition procedures outlined in paragraph 92 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commanding officer.

92. Methods of Destruction

a. SMASH. Smash the crystal, controls, tubes, coils, switches, capacitors, transformers, and headsets, using sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

b. CUT. Cut cords, headsets, and wiring, using axes, handaxes, or machetes.

c. BURN. Burn cords, resistors, capacitors, coils, wiring, and technical manuals, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. BEND. Bend panels, cabinet, and chassis.

e. EXPLOSIVES. If explosives are necessary, use firearms, grenades, or TNT.

f. DISPOSAL. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. DESTROY EVERYTHING.

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310-20-3 and SR 310-20-4. Check Department of the Army Supply Catalog SIG 1 for Signal Corps supply catalog pamphlets.

1. Army Regulations

AR 380-5	Military Security (Safeguarding Military Information).
AR 750-5	Maintenance of Supplies and Equipment (Maintenance Responsibility and Shop Operation).

2. Supply Publications

SIG 1	Introduction and Index.
SIG 3	List of Items for Troop Issue.
SIG 5	Stock List of All Items.
SIG 6	Sets of Equipment.
SIG 7&8	Organizational Maintenance Allowances and Field and Depot Maintenance Stockage Guide.
SB 11-47	Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11-76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Publications on Auxiliary Equipment and Test Equipment

TM 11-307	Signal Generator I-72-G, -H, -J, and -L.
TM 11-317	Signal Generator I-208(*).
TM 11-2524	Oscillator I-151-A.
TM 11-2526	Oscilloscope BC-1060-A.
TM 11-2627	Tube Tester I-177.
TM 11-4052	Signal Generators I-72-A, -B, -C, -D, -E, -G, -H, -J, and -K. Repair Instructions.
TM 11-5017	Output Meter TS-585A/U.
TM 11-5042	Frequency Meter TS-480/U.
TM 11-5511	Electronic Multimeter TS-505/U.
TM 11-5527	Multimeter TS-352/U.

4. Painting, Preserving, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.
TM 9-2851	Painting Instructions for Field Use.

5. Camouflage

FM 5-20	Camouflage, Basic Principles.

6. Decontamination

TM 3-220	Decontamination.

7. Demolition

FM 5-25	Explosives and Demolitions.

8. Other Publications

FM 24-18	Radio Communications.
FM 72-20	Jungle Warfare.
SR 310-20-3	Index of Training Publications.
SR 310-20-4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
SR 700-45-5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD -247).
SR 745-45-5 NAV DEPT SERIAL 85P00 AFR 71-4	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD-66 (Army), SandA -70-6 (Navy), and AF-MC-U2 (Air Force)).
TB SIG 4	Methods for Improving the Effectiveness of Jungle Radio Communication.
TB SIG 5	Defense Against Radio Jamming.

TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 54	Working Through Jamming with Frequency Modulated Radio Sets.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 219	Operation of Signal Equipment at Low Temperatures.
TB SIG 223	Field Expedients for Wire and Radio.
TB 11-499-()[1]	Basic Radio Propagation Predictions.
TM 9-2857	Storage Batteries Lead-Acid Type.
TM 11-314	Antennas and Antenna Systems.
TM 11-430	Batteries for Signal Communication. Except those pertaining to Aircraft.
TM 11-453	Shop Work.
TM 11-455	Radio Fundamentals.
TM 11-483	Suppression of Radio Noises.
TM 11-499	(Preliminary) Radio Propagation Handbook.
TM 11-660	Introduction to Electronics.
TM 11-661	Electrical Fundamentals (Direct Current).
TM 11-4000	Trouble Shooting and Repair of Radio Equipment.

[1] A new TB in this series is issued monthly which gives propagation predictions three months in advance.

9. Abbreviations

a-c	alternating-current
a-f	audio-frequency
cps	cycles per second
db	decibel
fm	frequency modulation
h-f	high-frequency
h-v	high-voltage
i-f	intermediate-frequency
kc	kilocycle
l-v	low-voltage
mc	megacycle
ua	microampere
uv	microvolt

APPENDIX II

IDENTIFICATION TABLE OF PARTS

1. Requisition of Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O&E, T/A, SIG 7 & 8, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7 & 8-AN/VRC-2X. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1, Introduction and Index.

2. Identification Table of Parts for Radio Set AN/VRC-2X

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	RADIO SET AN/VRC-2X: F3 type of emission, MBCA ref dwg group 5; 25 w output; 30-40 mc freq. range; 1 band; 24 v dc; components mp and fp; US Army spec 71-3290.	Vehicular, voice-operated, frequency-modulated radio transmitter, receiver, and associated components.	2S4502-2X
	TECHNICAL MANUAL TM 11-607.		Order thru AGC
H1, H2	BOLT, thumb: #8-32; 3/4" lg; Parker-Kalon type S, modified per Utility Electronics Corp dwg PB-3236.	Cover fastener for receiver and transmitter.	6L17108-8.49S
	BRACKET: ant. bkt support; L-shape; 8 7/8" lg x 5" wd x 6 1/2" h o/a; Sig C dwg SC-C-28591.	Antenna bracket support.	2Z1239.278
A2	BRACKET: Mast Base Bracket MP-50; ant. support; wedge shape; 8" lg x 5 1/4" wd x 5" h o/a; Sig C dwg SC-D-1520.	Antenna mounting bracket.	2A2090-50
	CABLE, power: electrical; Cordage CO-137; AF interconnecting; six #18 AWG stranded tinned copper cond; Sig C dwg SC-C-18897.	Cordage for receiver control cable.	3E2137
	CABLE, special purpose: electrical; Cordage CO-136; AF interconnecting; 6 cond, two #12 AWG, two #16 AWG, and two #20 AWG stranded tinned copper cond; Sig C spec 71-700.	Cordage for power interconnector cable.	3E2136
	CABLE, special purpose: electrical; Cordage CO-212; portable installation; 1 inner cond #8 AWG and 1 concentric cond #8 AWG; US Army spec 71-1618.	Cordage for battery cable.	3E2212
	CABLE, special purpose: electrical; type CO-03 MGF (8/20) SJ0485 per MIL spec MIL-C-3432.	Cordage for transmitter control cable.	1B4020-8.1
W3	CABLE ASSEMBLY, power: electrical; two #18 AWG stranded cond; 4' lg; Utility Electronics Corp dwg PB-1407.	Loudspeaker cable.	3E7350-1.48
W5	CABLE ASSEMBLY, RF: Cord CG-426A/U; coax; 73-ohm impedance; 3' 4" lg o/a; Sig C dwg SC-D-34932-1.	Transmitter-receiver interconnecting cable.	3E599A-2.17
W9	CABLE ASSEMBLY, RF: Cord CG-426A/U; coax; 73-ohm impedance; 7' lg o/a; Sig C dwg SC-D-34932-1.	Transmitter-receiver interconnecting cable.	3E5999A-2.16
W8	CABLE ASSEMBLY CX-1913/U: special purpose; electrical; cordage CO-212; 8' lg excluding term.; Sig C dwg SC-D-68572.	Power cable.	3E5999-7.8
W2	CABLE ASSEMBLY CX-1934/U: special purpose; electrical; 6 stranded cond, #18 AWG; 6' lg excluding term.	Receiver control cable.	3E5999-6.36
W1	CABLE ASSEMBLY CX-1935/U: special purpose; electrical; 8 stranded cond, #20 AWG; 6' lg excluding term.	Transmitter control cable.	3E5999-6.37
W7	CABLE ASSEMBLY CX-1936/U: special purpose; electrical; 2 stranded cond, #20 AWG; 2 stranded cond, #12 AWG; 8' lg excluding term.	Transmitter-receiver interconnecting cable.	3E5999-6.38
E5	CONNECTOR, adapter: Adapter UG-273/U; male 1 end, female other end; 1 rd male cont 1 end, 1 split female cont other end; straight type; 23/32" OD x 1-7/32" lg; Navy dwg RE49F389.	Antenna adapter.	2Z308-273
E6	CONNECTOR, adaper: Adapter UG-306/U; 1 rd male cont 1 end, 1 rd female cont other end; 90° angle type; 1" lg x 1" wd x 9/16" h; ANRFCCC dwg RE49F429.	Antenna adapter.	2Z308-306

2. Identification Table of Parts for Radio Set AN/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
P7, P8, P9, P10	CONNECTOR, plug: Plug UG-260/U; 1 male coax cont; straight type; 1" lg x 27/64" dia; ANRFCCC dwg RE49F380.	Cable terminations.	2Z7390-260
P6	CONNECTOR, plug: 3 rd male pol cont; straight type; 1-17/32" lg x 1.737" dia; Bendix-Scintilla #10-42622-2P	Cable termination.	2Z3023-76
P5	CONNECTOR, plug: 4 flat female cont; pol; straight type; 1¾" lg x 1-7/16" dia; Amphenol type 92-F1T.	Cable termination.	6Z3179
P33	CONNECTOR, plug: 4 rd male cont; pol; straight type; 1½" lg x ⅞" dia o/a; Amphenol part #91-MC4MT.	Connector plug.	2Z3024-105
P28	CONNECTOR, plug: 6 rd female cont; pol; straight type; 1¾" lg x 1½" dia; Amphenol type 79-06F1T.	Cable termination.	2Z3026-53
P27	CONNECTOR, plug: 6 rd male cont; pol; straight type; 1¾" lg x 1½" dia; Amphenol type 79-06MT.	Cable termination.	2Z3026-52
P11	CONNECTOR, plug: 8 rd female cont; pol; straight type; 1¾" lg x 1½" dia; Amphenol type 79-08F1-MT.	Cable termination.	2Z3069-57
P20	CONNECTOR, plug: 8 rd male cont; pol; straight type; 1⅞" lg x 1¼" dia; Amphenol type 79-08MT.	Cable termination.	2Z3028-71
E7	CONTROL RADIO SET C-1060/VRC-2X: squelch and vol control; 7⅜" lg x 3½" wd x 2⅜" h; table mtd; US Army spec 71-3290.	Control unit.	2C684-1060
LS2	DYNAMIC LOUDSPEAKER LS-158/U: PM field; cone type 5" dia; 3.2-ohm voice coil impedance; 5.390" dia housing x 2½" d; US Army spec 71-3290.	Converts electrical energy into mechanical energy.	6C43-43
LS3	DYNAMIC, LOUDSPEAKER: PM field; cone type 5" dia; 5-1/16" dia x 2½" d o/a; Best Mfg part 5-PM; (cone assy for Loudspeaker LS-158/U).	Converts electrical energy into mechanical energy.	6C43-41
E8	FUSE BOX J-498/VRC-2X: provides 2 entrances to fit AN-931-7-11 rubber grommet; 6⅛" lg x 2-3/16" wd x 2½" h; US Army spec 71-3290.	Fuse guard.	2Z5600-498
F2	FUSE, cartridge: Navy type 28044-25; 25 amp; 2" lg x 9/16" dia o/a; Buss type NON-25.	Overload protection.	3Z2625.13
E1	FUSEHOLDER: block type; accom 1 cartridge type fuse, 2" lg x 9/16" dia; 3½" lg x 1-7/16" wd x 1¾" h; Chase-Shawmut type 20675.	Fuseholder.	3Z3282-48
H10	GROMMET: rubber; fits ½" dia hole; ⅝" OD x ⅜" ID x ¼" thk w/1/16 wd groove; Atlan India Rub #230.	Cable entry.	6Z4856-8
H3, H24	GROMMET: fits 11/16" dia hole; 7/16" dia hole x 1/16" wd groove x 5/16" wd x 15/16" dia o/a; Atlan India Rub type 2282.	Cable entry.	6Z4856-45
H11	HANGER, microphone: holds mike when not in use; 5-5/16" lg x 2¾" wd x 1½" h o/a; Utility Electronics Corp dwg #PB-2877, #PB-2923.	Holding hook.	2B1096-1
A8	HOUSING: loudspeaker; 3" lg x 5½" dia; Utility Electronics Corp dwg #PD-1271.	Speaker housing.	2Z5091-128
	INSTALLATION KIT: for installing Radio Set AN/VRC-2X.	Mounting hardware.	2S4502-2X-V76/5
A1	MAST BASE AB-15/GR: ant. support; 15¼" lg x 3⅛" dia o/a; Sig C dwg SC-D-12517.	Antenna base.	2A2081-15

2. Identification Table of Parts for Radio Set AN/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
E3	MAST SECTION AB-23/GR: ant. sect.; 23½″ lg x 7/32″ dia x .012″ wall thk; Sig C dwg SC-D-13614.	Whip section of antenna.	2A2450-23
E4	MAST SECTION AB-24/GR: ant. sect.; 23½″ lg x 7/32″ dia x .012″ wall thk w/3/16″ steel ball on tapered end; Sig C dwg SC-D-13614.	Whip section of antenna.	2A2450-24
E2	MAST SECTION MS-117: ant. sect.; 39½″ lg, from .252″ to .373″ dia; Sig C dwg SC-D-12521.	Whip section of antenna.	2A2417
M11	MICROPHONE, carbon: 50-ohm impedance; unidirectional; 4″ lg x 2½″ wd x 2″ d; cable 5′ lg; Utility Electronics Corp dwg PC2924; (complete mike assy).	Converts mechanical energy into electrical energy.	2B1657-36
M4	MICROPHONE, carbon: 50-ohm impedance; unidirectional; 4″ lg x 2¼″ wd x 2″ d; Electro-Voice type 210-M-307.	Converts mechanical energy into electrical energy.	2B1657-35
A3, A18	MOUNTING: for rec and xmtr; Sig C dwg SC-D-28085 and SC-D-28106.	Shock mounting for chassis of receiver and transmitter.	2Z8405A-1
N5	PLATE, identification: marked Fuse Box J-498/VRC-2X; 2¼″ lg x ⅞″ wd x .032″ thk; Utility Electronics Corp dwg PB-3267.	Nomenclature plate.	2Z7090.137
	POWER SUPPLY PP-721/VRC-2X; vibrator type; non-synchronous; output 250 v dc, 80 ma; input 24 v dc, 3.5 amp; 8⅜″ lg x 3-27/32″ wd x 8-3/16″ h; US Army spec 71-3290.	Receiver power supply.	3H4497-721
	RADIO FREQUENCY CABLE RG-59A; coax; 73-ohm impedance; 21 uuf/ft; .242″ OD; JAN spec JAN-C-17.		1F425-59A
	RADIO RECEIVER R-435/VRC-2X: F3 reception, MBCA ref dwg group 5; 30-40 mc freq range; 24 v, 5 amp dc; 14¾″ lg x 9¼″ wd x 10¾″ h; superheterodyne ckt; US Army spec 71-3290.	Radio receiver.	2C4180-435
	RADIO TRANSMITTER T-322/VRC-2X: F3 type of emission, MBCA ref dwg group 5, 30 to 40 mc; 25 w output; 14¾″ lg x 9¼″ wd x 10¾″ h; US Army spec 71-3290.	Radio transmitter.	2C6703-7
O-9, O-35	RING, retainer: captive screw retainer; .171″ ID x .295″ OD x .031″ thk w/rim .062″ wd; Natl Lock Washer part WA510.	Captive screw retainer.	2Z7858-182
O-39	STUFFING TUBE: 1 packing chamber; straight type; .526″ bore dia; 2-13/64″ lg x 1⅜″ dia; Bendix-Scintilla part #10-35998-225.	Stuffing tube.	6Z3858-26

3. Identification Table of Parts for Radio Receiver R-435/VRC-2X

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	RADIO RECEIVER R-435/VRC-2X: F3 reception, MBCA ref dwg group 5; 30-40 mc freq range; 24 v, 5 amp dc; mtd in steel cabinet; 14¾″ lg x 9¼″ wd x 10¾″ h; 13 electron tubes and 2 thermal resistors; superheterodyne ckt; US Army spec 71-3290.	Radio receiver for any single selected frequency within the 30 to 40 mc range.	2C4180-435
	TECHNICAL MANUAL TM 11-607 w/supplements.		Order thru AGC
T2R	AMPLIFIER SUBASSEMBLY: plate tuning and coupling; 4″ lg x 2″ wd x 1-7/16″ d; Utility Electronics Corp part #PB-1475.	V1 r-f amplifier transformer.	2Z9629-202
T3R	AMPLIFIER SUBASSEMBLY: interstage coupling; 4″ lg x 2″ wd x 1-7/16″ d; Utility Electronics Corp part #PB-1477.	V3 mixer transformer.	2Z9643.343
T4R	AMPLIFIER SUBASSEMBLY: plate coupling; 4″ lg x 2″ wd x 1-7/16″ d; Utility Electronics Corp part #PB-1478.	V4 i-f amplifier transformer.	2Z9643.344
T5R	AMPLIFIER SUBASSEMBLY: plate tuning and coupling; 4″ lg x 2″ wd x 1-5/16″ d; Utility Electronics Corp part #PB-1479.	V5 converter transformer.	2Z9641.304
T6R	AMPLIFIER SUBASSEMBLY: interstage coupling; 4″ lg x 2″ wd x 1-7/16″ d; Utility Electronics Corp part #PB-1479.	V6 i-f amplifier transformer.	2Z9641.307
T7R	AMPLIFIER SUBASSEMBLY: interstage coupling; 4″ lg x 2″ wd x 1-7/16″ d; Utility Electronics Corp part #PB-1481.	V7 first limiter transformer.	2Z9641.305
T8R	AMPLIFIER SUBASSEMBLY: interstage coupling; 4″ lg x 2″ wd x 1-7/16″ d; Utility Electronics Corp part #PC-1482.	V8 second limiter transformer.	2Z9641.306
H34, H35	BOLT, thumb: rd head; ¼″-20 thd; 1-19/32″ lg; Utility Electronics Corp part #PB-3249.	Base fastener.	6L604-1.3
C5	CAPACITOR, fixed: ceramic dielectric; 2 uuf ±.25 mmf; 500 vdcw; JAN type CC30Ck020C.	V2 to V3 coupling.	3D9002-27
C13, C14, C20, C21	CAPACITOR, fixed: mica dielectric; 10 uuf ±10%; 500 vdcw; JAN type CM20B100K.	C13: V3 plate tuning. C14: V4 grid tuning. C20: V4 plate tuning. C21: V5 grid tuning.	3K2010021
C46, C50	CAPACITOR, fixed: mica dielectric; 39 uuf ±5%; 500 vdcw; JAN type CM20C390J.	C46, C50: V9 plate tuning.	3K2039032
C27, C28 C34, C35, C41, C42,	CAPACITOR, fixed; mica dielectric; 51 uuf ±5%; 500 vdcw; JAN type CM20C510J.	C27: V5 plate tuning. C28: V6 grid coupling. C34: V6 plate tuning. C35: V7 grid tuning. C41: V7 plate tuning. C42: V8 grid tuning.	3K2051032
C64	CAPACITOR, fixed: mica dielectric; 100 uuf ±10%; 500 vdcw; JAN type CM20B101K.	V12 amplifier input filter.	3K2010121
C75	CAPACITOR, fixed: mica dielectric; 270 uuf ±5%; 500 vdcw; JAN type CM20B271J.	Trap, 4.3 mc (part of T2R).	3K2027122
C16, C23, C29, C48, C49	CAPACITOR, fixed: mica dielectric; 510 uuf ±5%; 500 vdcw; JAN type CM20D511J.	C16: V4 grid r-f filter. C23: V5 grid r-f filter. C29: V6 grid r-f filter. C48, C49: V9 cathode r-f filter.	3K2051142

3. Identification Table of Parts for Radio Receiver R-435/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C10, C37, C44, C52, C54	CAPACITOR, fixed: mica dielectric; 2,200 uuf ±10%; 500 vdcw; JAN type CM30B222K.	C10: V3 grid coupling. C37: V7 grid r-f bypass. C44: V8 grid r-f bypass. C52: V10 grid coupling. C54: V10 plate load tuning.	3K3022221
C3, C4 C6, C8, C11, C17, C18, C24, C55, C57, C58, C62, C63, C72	CAPACITOR, fixed: mica dielectric; 5,600 uuf ±10%; 500 vdcw; JAN type CM35B562K.	C3: V1 cathode bypass. C4: V1 screen bypass. C6: V2 screen bypass. C8: V2 plate decoupling. C11: V1 plate decoupling. C17: V3 screen bypass. C18: V4 cathode bypass. C24: V4 screen bypass. C55: V11 input coupling. C57, C58: V11 output load. C62: V12 amplifier output coupling. C63: V12 amplifier input coupling. C72: B+ r-f bypass.	3K3556221
C39, C45, C53, C60	CAPACITOR, fixed; paper dielectric; 50,000 uuf ±20%; 600 vdcw; JAN type CP29A1EF503M.	C39: V7 screen bypass. C45: V8 screen bypass. C53: V10 cathode bypass. C60: V12 squelch plate bypass.	3DA50-259
C25, C30, C31, C32, C38, C59	CAPACITOR, fixed: paper dielectric; 50,000 uuf +20% —10% ea sect.; 600 vdcw; JAN type CP53B5EF503V.	C25: V5 cathode bypass. C30: V5 plate and screen decoupling. C31: V6 cathode bypass. C32: V6 plate and screen decoupling. C38: V7 bias filter, V11 to V7. C59: V12 amplifier input filter.	3DA20-279
C74	CAPACITOR, fixed: paper dielectric; 250,000 uuf ±20%; 200 vdcw; JAN type CP29A1EC254M.	Output transformer line bypass.	3DA250-340
C56, C61, C65	CAPACITOR, fixed: electrolytic; 3 sect.; 20 uf ea sect.; 450 vdcw; JAN type CE33F200B.	C56: V10 screen bypass. C61: V12 cathode bypass. C65: V13 cathode bypass.	3DB20-132
C7, C9, C12, C15, C19, C22, C33, C36, C40, C43, C47, C51, C76, C77	CAPACITOR, variable: air dielectric; plate meshing type; 2 sect.; 7-44 uuf; 1-5/16" lg x 1-3/16" wd x 1-13/32" h; Sickles FW type ATR-1 dual.	C7: V2 plate tuning. C9: V1 plate tuning. C12: V3 plate tuning. C15: V4 grid tuning. C19: V4 plate tuning. C22: V5 grid tuning. C33: V6 plate tuning. C36: V7 grid tuning. C40: V7 plate tuning. C43: V8 grid tuning. C47, C51: V9 plate tuning. C76: V3 grid tuning (T2R). C77: V3 grid tuning (T1R).	3D9044V-7
C26	CAPACITOR, variable: air dielectric; plate meshing type; 7-44 uuf; 1-5/64" lg x 1-13/16" wd x 1-13/32" d; Sickles FW part #ART-1 single.	V5 plate tuning.	3D9044V-5

3. Identification Table of Parts for Radio Receiver R-435/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C1	CAPACITOR, variable: air dielectric; plate meshing type; 1 sect.; 6-50 uuf; 1-3/16″ lg x 15/16″ wd x 1-7/32″ d; Sickles FW type SD-3443.	V1 grid tuning.	3D9050V-126
E46	CLIP, electrical: electron tube; 7/8″ lg x 5/16″ wd x 7/16″ h.	V5 grid clip.	2Z3712.22
L1	COIL, RF: ant.; unshielded; 13/16″ lg x .88″ dia; Utility Electronics Corp part #PA-1069.	Antenna primary coil.	3C1084Z74-7
L2	COIL, RF: ant.; unshielded; 29/32″ lg x .556″ dia; Utility Electronics Corp part #PA-1070.	Antenna secondary coil.	3C1084Z74-6
	COLLAR, spacing: stand-off; 3/16″ lg x 5/16″ dia; Utility Electronics Corp part #PA-1454.	Stand-off.	2Z2935-165
	COLLAR, spacing: 5/8″ lg x 11/16″ dia; Utility Electronics Corp part #PA-1472.	Spacer.	2Z2935-166
J7	CONNECTOR, receptacle: 1 rd female cont; straight type; red body; 1/2″ lg x 1/2″ dia; Amphenol part #78-1LT.	B+ power receptacle.	2Z3062-215
J2	CONNECTOR, receptacle: 1 rd female cont; straight type; yellow body; 1/2″ lg x 1/2″ dia; Amphenol part #78-1LT.	Filament power receptacle.	2Z3062-214
J6	CONNECTOR, receptacle: 1 rd female cont; straight type; 1-1/32″ lg x 1/2″ dia; Industrial Products Corp part #5575.	ANTENNA receptacle.	2Z3062-188
J5	CONNECTOR, receptacle: 8 rd female pol cont; straight type; 1″ lg x 1 3/8″ dia; Amphenol #79-P08FT.	Control cable receptacle.	2Z3069-52
	COVER, radio receiver: steel; 14-9/16″ lg x 9-3/16″ wd x 11-3/16″ h; Utility Electronics Corp part #PD-1163.	Receiver cover (less guard).	2Z3351-350
Y1	CRYSTAL UNIT, quartz: incl Crystal Holder HC-1/U; 1 3/8″ lg x 12-3/16″ wd x 7/16″ d; 4,755 kc freq; Sig C dwg SC-A-46042, SC-D-20877, SC-D-20879.	V5 frequency control.	2X28-4755
	GROMMET: rubber; fits 5/16″ hole; 3/16″ dia hole x 1/4″ wd x 7/16″ o/a; Canfield Rub #1971B.	Hole liner.	6Z4856-44
	GUARD SWITCH MX-1368/VRC-2X: steel; 14 7/8″ lg x 3 3/4″ wd x 4 1/4″ d; Army spec 71-3290.	Protective cover for switches and plugs.	2Z4883A-1368
	HANDLE: cover; 3″ lg x 2 3/4″ wd x 3/4″ d incl 1 3/4″ OD washer; National Lock Co part #61-207).	Cover handle.	2Z4928-106
J1	JACK JJ-034: for 2 cond plug; .250″ dia.	METER jack.	2Z5534
	KNOB: rd; black plastic; for 1/4″ dia shaft; 11/16″ dia x 13/32″ thk; Harry Davies Mold #1400-block.	Control knob.	2Z5821-4.1
	LATCH, fastener: for cover; 2″ lg x 5/8″ wd x 3/8″ d; Utility Electronics Corp dwg #PA-1473 (to fit National Lock Co part #61-207).	Cover fastener.	6Z6918-27
	MOUNTING: tube socket; steel cad pl; Utility Electronics Corp part #PB-3003.	Mounting for tube sockets.	2Z6820.441
T1R	OSCILLATOR SUBASSEMBLY: hf osc tuning; 4 1/2″ lg x 2″ wd x 1-7/16″ d; Utility Electronics Corp part #PB-1476-A.	V2 h-f oscillator tuning.	2Z9629-201
	PLATE, identification: control and connection indicator; 14-1/16″ lg x 2 1/2″ wd x .032″ thk; Utility Electronics Corp part #PB-1129.	Control and connection indicator.	2Z7091-655
	PLATE, instruction: caution; 3″ lg x 7/8″ wd x .032″ thk; Utility Electronics Corp part #PB-3255.	Caution plate.	2Z7091-656
	PLATE, stop: holds capacitor firm; 1″ lg x 33/64″ wd x .017″ thk; Utility Electronics Corp part #PA-1266.	Capacitor positioner.	2Z7091-654

3. Identification Table of Parts for Radio Receiver R-435/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
L3	REACTOR: 50 mh inductance; 190-ohm dc resistance; open steel frame; 1½" lg x 1" wd x 1⅝" d; Utility Electronics Corp part #PA-1072.	V10 plate load tuning.	3C573K-1
R2	RESISTOR, fixed: composition; 270 ohms ±10%; ½ w; JAN type RC20BF271K.	V1 cathode bias.	3RC20BF271K
R11, R15	RESISTOR, fixed: composition; 330 ohms ±10%; ½ w; JAN type RC20BF331K.	R11: V4 cathode bias. R15: V5 cathode bias.	3RC20BF331K
R23	RESISTOR, fixed: composition; 560 ohms ±10%; ½ w; JAN type RC20BF561K.	V6 cathode bias.	3RC20BF561K
R52	RESISTOR, fixed: composition; 1,000 ohms ±10%; 1 w; JAN type RC30BF102K.	V13 cathode bias.	3RC30BF102K
R4, R46, R53	RESISTOR, fixed: composition; 4,700 ohms ±10%; ½ w; JAN type RC20BF472K.	R4: V1 plate decoupling. R46: V12 cathode bias. R53: V2 plate decoupling.	3RC20BF472K
R14, R45	RESISTOR, fixed: composition; 6,800 ohms ±10%; ½ w; JAN type RC20BF682K.	R14: V5 hexode grid #3 grid leak. R45: V12 cathode bias bleeder.	3RC20BF682K
R12, R40	RESISTOR, fixed: composition; 15,000 ohms ±10%; 1 w; JAN type RC30BF153K.	R12: V4 plate and screen decoupling. R40: V10 plate and screen decoupling.	3RC30BF153K
R8, R18, R24, R30, R33	RESISTOR, fixed: composition; 27,000 ohms ±10%; 1 w; JAN type RC30BF273K.	R8: V3 plate and screen decoupling. R18: V5 hexode plate and screen decoupling. R24: V6 plate and screen decoupling. R30: V7 plate and screen decoupling. R33: V8 plate and screen decoupling.	3RC30BF273K
R7, R16, R26	RESISTOR, fixed: composition; 47,000 ohms ±10%; ½ w; JAN type RC20BF473K.	R7: V2 screen decoupling. R16: V5 triode grid leak. R26: V7 grid load.	3RC20BF473K
R47	RESISTOR, fixed: composition; 47,000 ohms ±10%; 1 w; JAN type RC30BF473K.	R47: V12 bias bleeder.	3RC30BF473K
R3	RESISTOR, fixed: composition; 68,000 ohms ±10%; ½ w; JAN type RC20BF683K.	V1 screen dropping.	3RC20BF683K
R10, R25, R29, R34, R36	RESISTOR, fixed: composition; 100,000 ohms ±10%; ½ w; JAN type RC20BF104K.	R10: V4 grid filter. R25: V6 plate load. R29: V7 grid le.ak R34, R36: V9 cathode load.	3RC20BF104K
R17, R48	RESISTOR, fixed: composition; 150,000 ohms ±10%; ½ w; JAN type RC20BF154K.	R17: V5 triode plate load. R48: V12 amplifier plate load.	3RC20BF154K
R21	RESISTOR, fixed: composition; 180,000 ohms ±10%; ½ w; JAN type RC20BF184K.	V6 grid leak.	3RC20BF184K
R50	RESISTOR, fixed: composition; 220,000 ohms ±10%; ½ w; JAN type RC220BF224K.	V12 amplifier input filter.	3RC20BF224K
R44	RESISTOR, fixed: composition; 270,000 ohms ±10%; ½ w; JAN type RC20BF274K.	V12 squelch plate voltage divider.	3RC20BF274K
R6, R9, R13, R39	RESISTOR, fixed: composition; 47,000 ohms ±10%; ½ w; JAN type RC20BF474K.	R6: V2 grid leak. R9: V4 plate load. R13: V3 plate load. R39: V10 input filter.	3RC20BF474K

3. Identification Table of Parts for Radio Receiver R-435/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R49	RESISTOR, fixed: composition; 820,000 ohms ±10%; ½ w; JAN type RC20BR824K.	V12 amplifier input filter.	3RC20BF824K
R19, R20, R22, R27, R32, R38. R41, R42, R43	RESISTOR, fixed: composition; 1 meg ±10%; ½ w; JAN w; JAN type RC20BF105K.	R19: Bias filter V11 to V7. R20: Grid decoupling V6 to V4. R22: V6 grid meter isolation. R27: Bias filter, V11 to V7. R32: V8 grid leak. R38: V10 grid leak. R41: V11 load. R42: V12 squelch input filter. R43: V12 squelch plate coupling.	3RC20BF105K
R28, R31	RESISTOR, fixed: composition; 1.5 meg ±10%; ½ w; JAN type RC20BF155K.	R28: V7 grid meter isolation. R31: V8 grid meter isolation.	3RC20BF155K
R51	RESISTOR, fixed: composition; 2.2 meg ±10%; ½ w; JAN type RC20BF225K.	V13 grid leak.	3RC20BF225K
R5	RESISTOR, fixed: composition; 4.7 meg ±10%; ½ w; JAN type RC20BF475K.	V3 grid leak.	3RC20BF475K
R56	RESISTOR, thermal; 35-ohm nom resistance; 450 ma, 7.16 w nom oper cur; T9 tube; Amperite part #4H12.	Filament voltage stabilizing.	3Z6925-3.26
R57	RESISTOR, thermal: 20-ohm nom resistance; 580 ma, 6.38 w nom oper cur; T9 tube; Amperite #6-13.	Filament voltage stabilizing.	3Z6925-3.21
0-48	RETAINER, crystal holder: holds xtal holder; 1⅜" lg x 1-3/16" wd x 7/16" d; Utility Electronics Corp #PA-1148.	Crystal holder retainer.	2Z2712.130
0-49, 0-50, 0-51	RETAINER, electron tube: SS; friction mtd; Times Facsimile part #2 Hat w/post.	O-49: Tube retainer. O-50: Thermal resistor retainer. O-51: Thermal resistor retainer.	2Z7780-165
X3 through X17	SOCKET, electron tube: 8 std octal cont; one piece saddle mtg; 1-9/16" lg x 1-7/32" wd x ½" h o/a; Cinch #51A14887.	Tube socket.	2Z8670.24
J8, X1, X2	SOCKET SO-200: 2 small cont; above chassis mtg; 1-13/64" lg x 41/64" wd x 13/16" h; Sig C dwg SC-D-16887.	J8: Speaker receptacle. X1: Crystal socket. X2: Crystal socket.	2Z8799-200
H41	STUD: 2½" lg x ¼" dia; 1 end threaded w/#6-32 thd 5/16" lg, other end threaded w/#6-32 thd ¼" lg; Utility Electronics Corp part #PA-1147.	Crystal retainer support.	6L31150-7
H42, H43, H44	STUD: 3⅛" lg x ⅛" dia; 1 end threaded w/5-40 #2 thd 7/16" lg, other end 1/32" x 45° cham; Utility Electronics Corp #PB-3004-2.	Tube retainer support.	6L31154-29
SW1	SWITCH, rotary: 1 pole 5 positions; 13/16" lg x 1¼" dia; Mallory part #3215J.	Meter switch.	3Z9825-55.6
E47	TERMINAL BOARD: mts resistors, capacitors, and connectors; 68 feedthrough swaged type term.; 13⅞" lg x 2¼" wd x 1¼" thk; Utility Electronics Corp part #PC-2925.	Mounting for resistors, capacitors, and connectors.	3Z770-68.6
T3	TRANSFORMER, AF: plate coupling type; pri 10,000-ohm impedance, secd 3.2- and 600-ohm impedance; HS case; 2" lg x 2" wd x 2½" h; Utility Electronics Corp part #PA-1021.	Audio output transformer.	2Z9632.528
V12	TUBE, electron: type 6C8G.	Squelch, first a-f amplifier.	2J6C8G
V9, V11	TUBE, electron: type 6H6GT.	V9: Discriminator. V11: Noise rectifier.	2J6H6GT

3. Identification Table of Parts for Radio Receiver R-435/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
V13	TUBE, electron: type 6K6GT.	2d a-f amplifier.	2J6K6GT
V5	TUBE, electron: type 6K8GT.	Converter.	2J6K8GT
V1, V2 V3, V4 V6, V7, V8, V10	TUBE, electron: type 6SG7GT.	V1: R-f amplifier. V2: H-f oscillator. V3: Mixer. V4: Amplifier, 4.3 mc i-f. V6: 455 kc i-f amplifier. V7: First limiter. V8: Second limiter. V10: Noise amplifier.	2J6SG7GT

4. Identification Table of Parts for Power Supply PP-721/VRC-2X

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	POWER SUPPLY PP-721/VRC-2X: vibrator type; non-synchronous; output 250 v dc, 80 ma; input 24 v dc, 3.5 amp; 8 3/8" lg x 3-27/32" wd x 8-3/16" h; filter incl; mts by one #8-32 anchor nut in horiz plane and two 1/8" dia holes in vert plane; mp and fp; US Army spec 71-3290.	Plate voltage supply for receiver.	3H4497-721
	BARE UNIT: for Power Supply PP-721/VRC-2X.		3H4497-721Z
C5	CAPACITOR, fixed: mica dielectric; 100 uuf ±10%; 500 vdcw; JAN type CM20B101K.	R-f bypass.	3K2010121
C3, C9	CAPACITOR, fixed: paper dielectric; 5000 uuf ±20%; 1500 vdcw; 1 1/4" lg x 1" dia; Dublier type MCC.	Buffer.	3DA5-241
C7, C8	CAPACITOR, fixed: mica dielectric; 5600 uuf ±10%; 500 vdcw; JAN type CM35B562K.	R-f filter.	3K3556221
C1, C2	CAPACITOR, fixed: paper dielectric; 500,000 uuf ±20%; JAN type CP29A1EC504M.	Input filter.	3DA500-582
C6	CAPACITOR, fixed: paper dielectric; 2.0 uf —15 +25%; 200 vdcw; 1-55/64" lg x .670" dia; Astron Corp type MQCF-2-2M.	Vibrator filter.	3DB2-285
C4	CAPACITOR, fixed: electrolytic; 2 sect., 20 uf per sect.; 450 vdcw; JAN type CE42F200R.	Output filter.	3DB20-113
O11, O12	CLIP: electrical, fuse; 15/32" jaw opening; 3/4" lg x 15/32" wd x 1/2" h; Buss type 4551.	Fuse clip.	2Z2712.194
O40, O41, O42	CLIP: electrical, capacitor; 9/16" max jaw opening; 53/64" lg x 19/32" wd x 41/64" h; Kolten part/dwg #EA-1.	Capacitor clips.	2Z2712.288
O13	CLIP: electrical, vibrator; 1 1/2" jaw opening; 1 7/8" lg x 1 5/8" wd x 17/32" h; United Carr type #52035.	Vibrator clip.	2Z2712.175
L2	COIL, RF: fil choke; unshielded; 27/32" lg x 1-5/16" dia; Utility Electronics Corp part/dwg #PA-1068.	Filament choke.	3C1084Z74-4
L1	COIL, RF: choke; unshielded; 27/32" lg x 1-5/16" dia; Utility Electronics Corp part/dwg #PA-1071.	Input filter.	3C1084Z74-5
P4	CONNECTOR, plug: 1 rd male cont; straight type; 3/8" lg, excluding cont, x 1/2" dia; blk; Amphenol part #71-1L.	Rectifier filament connection.	2Z3021-198

4. Identification Table of Parts for Power Supply PP-721/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
P2	CONNECTOR, plug: 1 rd male cont; straight type; 3/8" lg x 1/2" dia; red; Amphenol part #71-1LT.	B+ output.	2Z3021-207
P3	CONNECTOR, plug: 1 rd male cont; straight type; 3/8" lg x 1/2" dia; yellow; Amphenol part #71-1LT.	Filament connection.	2Z3021-206
P1	CONNECTOR, receptacle: 6 rd male cont; pol, straight type; 1 1/8" lg x 1 3/8" dia; Amphenol part #79-PO6M-T.	Power connector.	2Z3026-40
F1	FUSE, cartridge: 5 amp; 1 1/2" lg x 13/32" dia; Buss type #AGU-5.	Overload protection.	3Z2605.7
E18	FUSEHOLDER: extractor post type; for one cartridge type fuse; 1 1/2" lg x 13/32" dia; 2-7/16" lg x 1-25/32" h x 1 1/8" wd; Buss type HPC-HWP.	Fuseholder.	3Z2876-6.4
E19, E20, E21, E22	INSULATOR, standoff: cylindrical pillar shape; brown polished bakelite; 7/8" lg o/a x 1/4" dia; Utility Electronics Corp dwg #PA-1610.	Standoff terminal.	3G350-145
O17	PLATE, stop: holds capacitor firm; 1" lg x 33/64" wd x .017" thk, excluding 1/16" lip; Utility Electronics Corp dwg #PA-1266.	Prevents capacitor from turning.	2Z7091-654
L3	REACTOR: 2.25 hy —10% +infinity; 80 ma dc; 600 ohms dc resistance; HS case; 2-13/16" sq x 2 7/8" h; UTC type E-4680.	B+ filter choke.	3C321-20
R1	RESISTOR, fixed: composition; 4700 ohms ±10%; 1/2 w; JAN type RC20BF472K.	R-f suppressor.	3RC20BF472K
R2	RESISTOR, fixed: composition; 100,000 ohms ±10%; 2 w; JAN type RC42BE104K.	B+ bleeder.	3RC42BE104K
X1	SOCKET, electron tube: 4 med cont; molded in plate mtg; 1 7/8" lg x 1-9/32" wd x 15/32" d; Amphenol type #77-M1P-4TM.	Vibrator socket.	2Z8674.84
X2, X3	SOCKET, electron tube: 8 std octal cont; one piece saddle mtg; 1-9/16" lg x 1-7/32" wd x 1/2" h o/a; Cinch type 51A14887.	Tube sockets.	2Z8670.24
T1	TRANSFORMER, power: vibrator; input 24 v dc, 1.86 amp; output 560 v, .080 amp; HS metal case; 3 3/8" lg x 3 1/4" wd x 4-3/16" h; Utility Electronics Corp part/dwg #PB-3000.	Vibrator transformer.	2Z9625-83
V1, V2	TUBE, electron: type 6X5WGT.	Full-wave rectifiers.	2J6X5WGT
E1	VIBRATOR, nonsynchronous: input 24 v dc, 2.0 amp; 3-3/16" lg x 1 1/2" dia; ATR type 24831.	Converts dc to ac.	3H6691-49

5. Identification Table of Parts for Radio Transmitter T-322/VRC-2X

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	RADIO TRANSMITTER T-322/VRC-2X: F3 type of emission, MBCA ref dwg group 5; 30-40 mc; xtal controlled; 25 w output; 24 v DC, 8.3 amp; inclosed in metal case; 14 3/4" lg x 9 1/4" wd x 10 3/4" h; Army Spec 71-3290. TECHNICAL MANUAL 11-607.	Radio transmitter for any single selected frequency within the 30 to 40-mc band.	2C6703-7

5. Identification Table of Parts for Radio Transmitter T-322/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
T3	AMPLIFIER SUBASSEMBLY: 1st quadrupler transf; shielded; 4″ lg x 2″ wd x 1½″ d; marked T3 w/ckt diagram; Utility Electronics dwg #PB-1485.	V4 first quadrupler transformer.	2C428-3
T4	AMPLIFIER SUBASSEMBLY: 2nd quadrupler transf; shielded; 4″ lg x 2″ wd x 1½″ d; marked T4 w/ckt diagram; Utility Electronics dwg #1486.	V5 second quadrupler transformer.	2C428-4
T5	AMPLIFIER SUBASSEMBLY: doubler transf; shielded; 4″ lg x 2″ wd x 1½″ d; marked T5 w/ckt diagram; Utility Electronics dwg #PB-1487.	V6 double transformer.	2C428-2
H12, H13	BOLT, thumb: RH; ¼″ —20; 1-19/32″ lg; Utility Electronics part #PB-3249.	Base fastener.	6L604-1.3
	BRUSH SET, electrical contact: u/w dynamotor; 2 input and 2 output brushes; ea marked w/polarity "+" or "—"; p/o Dynamotor DY-85/VRC-2X; Morganite Co per Electro-Engrg Prod Co dwg A-17164 and A-17237.	Dynamotor brushes.	3H535EP
O1	CAP: electrical; cover for connectors not in use; ½″ lg x ⅞″ dia; Amphenol #91-CCC-3.	Connector cover.	2Z1607-64
C43	CAPACITOR, fixed: mica dielectric; 5 uuf ±20%; 500 vdcw; JAN type CM25BO5OM.	V1 oscillator feedback.	3K2505024
C2, C5	CAPACITOR, fixed: mica dielectric; 24 uuf ±5%; 500 vdcw; JAN type CM20B240J.	C2: V1 oscillator plate tuning. C5: Phase shifting capacitor.	3K2024022
C24	CAPACITOR, fixed: mica dielectric; 51 uuf ±5%; 500 vdcw; JAN type CM20B510J.	V7 grid coupling.	3K2051022
C3, C6, C11	CAPACITOR, fixed: mica dielectric; 100 uuf ±10%; 500 vdcw; JAN type CM20B101K.	C3: V2 grid coupling C6: V3 grid coupling. C11: V4 grid coupling.	3K2010121
C31, C32	CAPACITOR, fixed: mica dielectric; 2000 uuf ±5%; 500 vdcw; JAN type CM30B202J.	Modulation filters.	3K3020222
C4, C13, C14, C16, C17, C18, C20, C21, C23, C34	CAPACITOR, fixed: mica dielectric; 2200 uuf ±10%; 500 vdcw; JAN type CM30B222K.	C4: V2 and V3 grid r-f meter bypass. C13: V4 grid r-f meter bypass. C14: V4 screen bypass. C16: V4 plate decoupling. C17: V5 r-f grid filter. C18: V5 screen bypass. C20: V5 plate decoupling. C21: V6 r-f grid filter. C23: V6 plate decoupling. C34: V7 grid r-f meter bypass.	3K3022221
C1, C7, C12, C22, C26, C27	CAPACITOR, fixed: mica dielectric; 5600 uuf ±10%; 500 vdcw; JAN type CM35B562K.	C1: V1 grid r-f meter bypass C7: V1 plate decoupling. C12: V2 and V3 plate decoupling. C22: V6 screen bypass. C26: V7 cathode bypass. C27: V7 screen bypass.	3K3556221
C30	CAPACITOR, fixed: mica dielectric; 10,000 uuf ±10%; 1200 vdcw; JAN type CM50B103K.	Antenna coupling.	3K5010321
C9, C10, C25	CAPACITOR, fixed: paper dielectric; 50,000 uuf ±20%; 600 vdcw; JAN type CP29A1EF503M.	C9: V2 and V3 grids No. 2 bypass. C10: V2 and V3 grids No. 3 and 5 bypass. C25: B+ filter.	3DA50-259

5. Identification Table of Parts for Radio Transmitter T-322/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C35, C36	CAPACITOR, fixed: paper dialectric; 2 uf +20%—10%; 1000 vdcw; JAN type CP40B2EG205V.	B+ filters.	3DB2-233
C8, C33	CAPACITOR, fixed: electrolytic; 2 sect: 45 uf ea sect. 150 vdcw; JAN type CE42C450J.	C8: V2 cathode bypass. C33: Carbon microphone d-c filter.	3DB45-10
C28	CAPACITOR, variable: air dielectric; plate meshing type; 7 to 35 uuf; 1-7/16″ lg x 1-11/16″ wd x 1⅝″ h; Bud Rad #2003.	V7 plate tuning.	3D9035V-52
C37, C38, C41	CAPACITOR, variable: air dielectric: plate meshing type; 1 sect. 7 to 44 uuf; 1-5/64″ lg x 1-13/16″ wd x 1-13/32″ h; Sickles FW type ATR-1 single.	C37: V1 plate tuning. C38: V2 and V3 plate tuning. C41: V6 plate tuning.	3D9044V-5
C39A, C39B, C40A, C40B	CAPACITOR, variable: air dielectric; plate meshing type; 2 sect.; 7 to 44 uuf; 1-5/64″ lg x 1-13/16″ wd x 1-13/32″ h; Sickles FW type ATR-1 dual.	C39A: V4 plate tuning. C39B: V5 grid tuning. C40A: V5 plate tuning. C40B: V6 grid tuning.	3D9044V-7
C29	CAPACITOR, variable: air dielectric; plate meshing type; 6-170 uuf; 2-1/16″ lg x 1-45/64″ wd x 1-45/64″ h; Bud Rad #CE-20032.	Antenna tuning.	3D9170V-3
O28	CLIP: electrical; electron tube; 13/16″ lg x 13/32″ wd x 5/16″ h; ICA part #1550.	V7 plate cap (part of W12).	2Z1613-2
L1	COIL, RF: ant. tuning; 6 turns; unshielded; 1½″ lg x 1-13/64″ OD; 37-40 mc range; Utility Electronics Corp dwg #PA-1055-1.	Antenna tuning 37 to 40 mc.	3C1084Z74-2
L1	COIL, RF: ant. tuning; 7 turns; unshielded; 1½″ lg x 1-13/64″ OD; 33-37 mc; Utility Electronics Corp dwg #PA-1055-6	Antenna tuning 33 to 37 mc.	3C1084Z74-1
L1	COIL, RF: ant. tuning; 8 turns; unshielded; 1½″ lg x 1-13/64″ OD; 30-33 mc; Utility Electronics Corp dwg #PA-1055-2.	Antenna tuning 30 to 33 mc.	3C1084Z74
RFC1, RFC2	COIL, RF: r-f choke; unshielded; 29/32″ lg x 29/32″ dia; Utility Electronics Corp dwg #PA-1054.	RFC1: V7 grid r-f choke. RFC2: V7 plate r-f choke.	3C1084Z74-3
O7, O8	COLLAR, spacing: standoff; 13/32″ lg x ⅜″ dia; u/w Dynamotor DY-85/VRC-2X; Utility Electronics Corp dwg #PA-1455.	Spacer.	3H987-6
J3, J5	CONNECTOR, receptacle: 1 rd female cont; straight; 1-1/32″ lg x ½″ dia; Industrial Products Corp #5575.	J3: ANTENNA connector. J5: RECEIVER connector.	2Z3062-188
P2	CONNECTOR, receptacle: 4 flat male pol cont; 1⅜″ lg x 1⅜″ dia; Amphenol type #92-CIT.	POWER connections to battery cable.	2Z3024-92
J2	CONNECTOR, receptacle: 4 rd female pol cont; straight; 11/16″ lg x 1¼″ dia; Amphenol type #91-PC4FT.	MIC connections.	2Z3065-91
J4	CONNECTOR, receptacle: 6 rd pol female cont; straight; 1-1/32″ lg x 1½″ dia; Amphenol #79-PO6FT.	RECEIVER connections.	2Z2067-44
P1	CONNECTOR, receptacle: 8 rd male pol cont; straight; 29/64″ lg x 1-7/64″ dia; Amphenol #79-PO8MT.	CONTROL connections to transmitter control cable.	2Z3069-51
A16	COVER: radio receiver; used as rec or xmtr cover; 14-9/16″ lg x 9¼″ wd x 11-3/16″ h; Utility Electronics Corp #PD-1163.	Cover.	2Z3351-350
	CRYSTAL UNIT, quartz: incl Crystal Holder HC-1/U; 1⅜″ lg x 1-3/16″ wd x 7/16″ d; 1 xtal plate; 4755 freq; Sig dwg SC-A-46042, SC-D-20877, SC-D-20879.	V1 Frequency control.	2X28-4755

5. Identification Table of Parts for Radio Transmitter T-322/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
D1	DYNAMOTOR DY-85/VRC-2X: power supply; 600 v, .175 amp, 105 w dc output; 24 v, 8 amp dc input; 7 3/8" lg x 4 3/4" wd x 4 3/8" h; Electro-Engineering Co #G1740o.	D-c power source for transmitter.	3H1535-85
F1	FUSE, cartridge: 20 amp, 32 v; 1 1/2" lg x 13/32" dia; Buss type AGU-20.	Overload protector.	3Z2620.17
E26	FUSEHOLDER: extractor post type; for 1 cartridge type fuse, 1 1/2" lg x 13/32" dia; 2-7/16" lg x 1-25/32" h x 1 1/8" wd; Buss type HPC-HWP.	Fuseholder.	3Z2876-6.4
	GUARD SWITCH MX-1368/VRC-2X: 14 7/8" lg x 3 3/4" wd x 4 1/4" d; connector and control guard; Utility Electronics Corp dwg #PD-3220.	Plug guard and cover.	2Z4883A-1368
H14, H15	HANDLE: cover; 3" lg x 2 3/4" wd x 3/4" d incl 1 3/4" OD washer; Natl Lock part #61-207.	Cover handle.	2Z4928-106
E27	INSULATOR, bushing: rectangular; natural phenolic, grade LTS-E-2, polished; 1 3/8" lg x 1" wd x 7/8" h; Utility Electronics Corp dwg #PA-1102.	Feedthrough insulator.	3G320-325
E28, E29	INSULATOR, standoff: rd post shape; JAN type NS5WO112.	Standoff insulator.	3G3501-12.1
J1	JACK JJ-034: tel; for 2 cond plug, shank 1/4" dia.	METER jack.	2J5534
	KNOB: rd; black bakelite; f/1/4" dia shaft; 11/16" dia x 13/32" h; w/pointer; Davies type 1400.	Control knob.	2Z5821-4.1
H16, H17	LATCH, fastener: cover fastener; 2" lg x 5/8" wd x 3/8" d; to fit Natl Lock, part #61-207.	Cover fastener.	6Z6918-27
W12	LEAD, electrical: wire braid 1/4" wd; 2 1/2" excluding term.; Utility Electronics Corp dwg #PA-1156.	V7 plate lead.	3E7998-2.11
T2	MODULATOR SUBASSEMBLY: modulator transf; 4" lg x 2" wd x 1 1/2" d; marked T-2 w/ckt diagram; Utility Electronics Corp dwg #PB-1484.	V2 and V3 modulator transformer.	2G2543
T1	OSCILLATOR SUBASSEMBLY: osc transf; shielded; 4" lg x 2" wd x 1 1/2" d; marked T1 w/ckt diagram; Utility Electronics Corp dwg #PC-1483.	V1 oscillator transformer.	2C2798-20
N6	PLATE, identification: 3" lg x 7/8" wd x .032" thk; Utility Electronics Corp dwg #PA-3223.	Nomenclature plate.	2Z7090.102
	PLATE, identification: 4" lg x 2" wd x .032" thk; Utility Electronics Corp dwg #PA-2933A.	Identification plate.	2Z7090.109
N7	PLATE, identification: 14-1/16" lg x 2 1/2" wd x .036" thk; Utility Electronics Corp dwg #PB-1119.	Control identification plate.	2Z7090.103
N8	PLATE, instruction: caution; 3" lg x 7/8" wd x .032" thk; Utility Electronics Corp part #PB-3255.	Caution plate.	2Z7091-656
N4	PLATE, instruction: caution; 3" lg x 1" wd x .032" thk; p/o Dynamotor DY-85/VRC-2X; Utility Electronics Corp dwg #PB-3256.	Caution plate.	3H4280-5
A6	PLATE, mounting: dynamotor mtg; 8 1/4" lg x 5" wd x 5/16" h; p/o Dynamotor DY-85/VRC-2X; Utility Electronics Corp dwg #PB-3257.	Dynamotor mounting plate.	3H4280-30
RY3	RELAY, armature: TPDT; single wnd; 24 v dc oper voltage; 2-11/16" lg x 1 5/8" wd x 1 1/2" h; Allied Cont type #HRX-9D-34.	Receive-transmit control.	2Z7592-116
RY2			
RY1,	RELAY, solenoid: SPST; 29 v dc oper voltage; 2 7/8" lg x 1 3/4" wd x 2 5/8" h; Allen Bradley Bulletin #X91419.	RY1: Power on-off control. RY2: Press-to-talk relay.	2Z7586-221

5. Identification Table of Parts for Radio Transmitter T-322/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R33	RESISTOR, fixed: composition; 18 ohms ±10%; ½ w; JAN type RC20BF180K.	V7 grid metering.	3RC20BF180K
R40	RESISTOR, fixed: wire-wound; 20 ohms ±5%; 4.5 w; JAN type RW29J200.	V5 and V6 filament shunt.	3RW14133
R6, R14, R18, R22	RESISTOR, fixed: composition; 100 ohms ±10%; ½w; JAN type RC20BF101K.	R6: V2 and V3 grid metering. R14: V4 grid metering. R18: V5 grid metering. R22: V6 grid metering.	3RC20BF101K
R8	RESISTOR, fixed: composition; 330 ohms ±10%; ½ w; JAN type RC20BFF331K.	V2 and V3 cathode bias.	3RC20BF331K
R2, R15, R19, R23	RESISTOR, fixed: composition; 1000 ohms ±10%; ½ w; JAN type RC20BF331K.	R2: V1 grid metering. R15: V2 and V3 plate decoupling. R19: V4 plate decoupling. R23: V5 plate decoupling.	3RC20BF102K
R31	RESISTOR, fixed: composition; 1800 ohms ±10%; ½ w; JAN type RC20BF182K.	Carbon microphone d-c dropping resistor.	3RC20BF182K
R24	RESISTOR, fixed: composition; 2200 ohms ±10%; ½ w; JAN type RC20BF222K.	V6 screen dropping.	3RC20BF222K
R32, R36	RESISTOR, fixed: wire-wound; 2500 ohms ±5%;12 w; JAN type RW26707.	B+ dropping resistors.	3RW26707
R7	RESISTOR, fixed: composition; 4700 ohms ±10%; ½ w; JAN type RC20BF472K.	V1 plate decoupling.	3RC20BF472K
R3	RESISTOR, fixed: composition; 10,000 ohms ±10%; ½ w; JAN type RC20BF103K.	Phase shifting resistor.	3RC20BF103K
R27, R30	RESISTOR, fixed: composition; 22,000 ohms ±10%; ½ w; JAN type RC20BF223K.	Modulation filters.	3RC20BF223K
R34	RESISTOR, fixed: composition; 22,000 ohms ±10%; 1 w; JAN type RC30BF223K.	V7 grid leak.	3RC30BF223K
R26, R37, R38, R39	RESISTOR, fixed: composition; 22,000 ohms ±10%; 2 w; JAN type RC42BE223K.	V7 screen dropping resistors.	3RC42BE223K
R35	RESISTOR, fixed: composition; 27,000 ohms ±10%; ½ w; JAN type RC20BF273K.	Antenna bleeder.	3RC20BF273K
R11, R12	RESISTOR, fixed: composition; 33,000 ohms ±10%; ½ w; JAN type RC20BF333K.	V2 and V3 grids No. 3 and 5 dropping resistors.	3RC20BF333K
R4, R5	RESISTOR, fixed: composition; 47,000 ohms ±10%; ½ w; JAN type RC20BF473K.	R4: V2 grid leak. R5: V3 grid leak.	3RC20BF473K
R9, R10	RESISTOR, fixed: composition; 100,000 ohms ±10%; ½ w; JAN type RC20BF104K.	V2 and V3 grids No. 2 dropping resistors.	3R20BF104K
R16, R20	RESISTOR, fixed: composition; 150,000 ohms ±10%; ½ w; JAN type RC20BF154K.	R16: V4 screen dropping. R20: V5 screen dropping.	3RC20BF154K
R13, R17, R21, R28, R29	RESISTOR, fixed: composition; 220,000 ohms ±10%; ½ w; JAN type RC20BF224K.	R13: V4 grid leak. R17: V5 grid leak. R21: V6 grid leak. R28, R29: Microphone transformer load.	3RC20BF224K
R1	RESISTOR, fixed: composition; 470,000 ohms ±10%; ½ w; JAN type RC20BF474K.	V1 grid leak.	3RC20BF474K
R25	RESISTOR, fixed: wire-wound; .51 ohm ±5%; ½ w; JAN type RU3BR51J.	V7 cathode bias.	3RU03601

5. Identification Table of Parts for Radio Transmitter T-322/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R41	RESISTOR, thermal: 10 ohms; 860 ma, 688 mw oper cur; RMA size T9; ballast tube type; 2⅞" lg excluding cont x 1-3/16" dia; Amperite type #9-8.	Filament current regulator.	3Z6925-3.27
O24	RETAINER, crystal holder: 1⅜" lg x 1-3/16" wd x 7/16" d; Utility Electronics Corp part #PA-1148.	Crystal holder.	2Z2712.130
025, 033	RETAINER, electron tube: for ST-14 and ST-16 envelopes; Times Facsimile Co #4T Hat (w/o post).	Tube retainers.	2Z7780-166
026	RETAINER, electron tube: SS; friction mtd; Times Facsimile Co #2T (w/o post).	Tube retainer.	2Z7780-165
X2	SOCKET SO-200; two small cont; 1-13/64" lg x 41/64" wd x 13/16" h; Sig C dwg SC-D-16887.	Crystal socket.	2Z8799-200
X1	SOCKET, electron tube: 5 med cont; saddle or retaining ring mtg; 1¼" dia; Millen #33005.	Tube socket.	2Z8675.29
X4, X5, X6, X7, X8	SOCKET, electron tube: 8 cont; octal; one piece saddle mtg;; 1⅝" lg x 1-9/32" wd x 29/64" h; Amphenol #88-8XTM.	Tube sockets.	2ZK8678-6
X3, X16	SOCKET, electron tube: 8 cont; octal below chassis mtg; 1-1/16" dia x ½" thk; Cinch #51A14887.	Tube sockets.	2Z8670.24
	SPRING: flat type; catch for cover; 3-9/16" lg x 7/16" wd x ½" h; also may be used for rec cover; Utility Electronics Corp dwg #PA-1258.	Cover catch spring.	2Z8877.696
	STUD: SS; 3⅛" lg x ¼" dia; 1 end threaded 7/16" lg w/#5-40 thk; #PB-3004-2.	Tube retainer support.	6L31154-29
	STUD: SS; 4⅝" lg x ⅛" dia; 1 end threaded 7/16" lg w/#5-40 thd; Utility Electronics Corp part/dwg #PB-3004-1.	Tube retainer support.	6L31164-4
S1	SWITCH, rotary: 1 pole, 7 throws; 1 sect.; 7/16" thk x 1¼" dia; Mallory dwg B-120103, part #3217J.	METER switch.	3Z9825-70.13
	TERMINAL BOARD: general purpose; 2 double screw term.; 1⅝" lg x 1⅛" wd x ½" thk o/a; Jones HB Div part #2-141.	Connecting block.	2Z9402.44
	TERMINAL BOARD: general purpose; 2 double screw term.; 2½" lg x 1-13/16" wd x ¾" h; Jones HB Div #2-150.	Dynamotor connector.	2Z9402.59
	TERMINAL BOARD: 6 feedthrough swaged type term.; 2¾" lg x 2" wd x 39/64" thk; marked C14, C18, C22; Utility Electronics Corp dwg #PA-1304.	Resistor mounting.	3Z770-6.122
	TERMINAL BOARD: 6 hollow swaged type term.; 3½" lg x 1⅞" wd x 17/32" thk; marked R26, R37; Utility Electronics Corp dwg #PA-1308.	Resistor mounting.	3Z770-6.121
	TERMINAL BOARD: resistor and capacitor mtg; 8 feedthrough swaged type term.; 3¼" lg x 2½" wd x 39/64" thk; marked R8, R27, R28, R30, C31, C32; Utility Electronics Corp dwg #PA-1302.	Resistor and capacitor mounting.	3Z770-8.106
	TERMINAL BOARD: mtg for resistors, capacitors, coils; 15 feedthrough swaged type term.; 4½" lg x 2½" wd x ⅞" thk; Utility Electronics Corp dwg #PA-1314.	Resistor, capacitor, and coil mounting.	3Z770-15.29
	TERMINAL BOARD: resistor and capactior mtg; 26 hollowed swaged type term.; 6-3/16" lg x 1½" wd x 17/32" thk; Utility Electronics Corp dwg #PB-1263.	Resistor and capacitor mounting.	3Z770-26.29

5. Identification Table of Parts for Radio Transmitter T-322/VRC-2X (contd)

T6	TRANSFORMER, AF: line type; pri 50 ohms impedance, secd 50,000 ohms CT; HS steel case; 2⅞″ lg x 2⅜″ dia o/a; UTC #E4685.	Microphone input transformer.	2Z9637.97
V6	TUBE, electron: type 6V6GTY.	Doubler.	2J6V6GTY
V2, V3	TUBE, electron: type 7A8.	Modulators.	2J7A8
V1, V4, V5	TUBE, electron: type 7C7.	V1: Oscillator. V4: First quadrupler. V5: Second quadrupler.	2J7C7
V7	TUBE, electron: type 807.	Power amplifier.	2J807

6. Identification Table of Parts for Radio Set Control C-1060/VRC-2X

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CONTROL RADIO SET C-1060/VRC-2X: squelch and vol control; 7⅜″ lg x 3½″ wd x 2⅜″ h; table mtd; steel case; US Army spec 71-3290.	Radio set control.	2C684-1060
	TECHNICAL MANUAL TM 11-607.		Order thru AGC
O-5, O-52	CLIP, electrical: fuseholder; 29/64″ lg x 11/32″ wd x 5/16″ h; ¼″ jaw opening; Littelfuse type 121001.	Spare fuseholders.	3Z1013.6
P29, P30	CONNECTOR, plug: 1 rd male cont; straight type; ⅜″ lg excluding term. x ½″ dia; Amphenol part #71-1LT.	Connection plugs.	2Z3021-206
J1	CONNECTOR, receptacle: 4 rd female pol cont; straight type; 11/16″ lg excluding cont x 1⅛″ dia; Amphenol type #91-PC4FT.	Michrophone connector.	2Z3065-91
F1	FUSE, cartridge: 10 amp, 32 v; 1½″ lg x 13/32″ dia; Buss type #AGU-10.	Overload protection.	3Z2610.1
E44	INSULATOR, standoff: cylindrical pillar shape; brown polished bakelite; ⅞″ lg o/a x ¼″ dia; Utility Electronic Corp part #PA-1610.	Insulator.	3G350-145
	KNOB: bar; black bakelite; for ¼″ dia shaft; marked w/ white line; 1¼″ lg x ¾″ wd x ⅝″ thk; Harry Davies Mold part #2300-black.	Volume control knob.	2Z5786.47
N3	LABEL: ckt; 6⅛″ lg x 2⅛″ wd x .005″ thk; Utility Electronics Corp part #PB-3203.	Circuit label.	6D16797-4
M2, M3	LAMP, incandescent: 28 v, .17 amp; miniature bayonet base; 15/16″ h o/a; GE #356.	Pilot lamps.	2Z5877-33
W10	LEAD, electrical: uses Sig C stk No. 1B1720.7 wire; 1-3/16″ lg excluding term; Utility Electronics Corp part #PA-1365.	Jumper lead.	3E7998-1.12
I1	LIGHT, indicator: w/green lens; f/G 3½ miniature bayonet base lamp; 1-9/16″ lg x 1″ wd x 1″ h; Dialco #855MB-432.	Pilot light.	2Z5991-248
I2	LIGHT, indicator: w/red lens; f/G 3½ miniature bayonet base lamp; 1-9/16″ lg x 1″ wd x 1″ h; Dialco #855-MB-1/32.	Pilot light.	2Z5991-247
N2	PLATE, identification: marked "Signal Corp US Army Radio Set Control C-1060/VRC-2X Utility Electronics Corp"; 3½″ lg x 1″ wd x .032″ thk; Utility Electronics Corp part #PA-3202.	Nomenclature plate.	2Z7093-267
N1	PLATE, identification: marked "SQUELCH" and "VOLUME"; 6-9/32″ lg x 2⅛″ wd x .036″ thk; Utility Electronics Corps part #PB-1145.	Control indicator.	2Z7093-268

6. Identification Table of Parts for Radio Set Control C-1060/VRC-2X (contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R1	RESISTOR, fixed: composition; 68 ohms ±10%; ½ w; JAN type RC20BF680K.	Voltage dropping.	3RC20BF680K
R5	RESISTOR, fixed: composition; 220 ohms ±10%; ½ w; JAN type RC20BF221K.	Squelch limiting.	3RC20BF221K
R2	RESISTOR, fixed: composition; 270 ohms ±10%; ½ w; JAN type RC20BF271K.	V1 cathode (transmitter).	3RC20BF271K
R3	RESISTOR, variable: composition; rotating brush type; 75,000 ohms ±20%; ½ w; 11/16" lg x 1⅛" dia; IRC type Q.	Squelch control.	3Z7475-17
R4	RESISTOR, variable: composition; rotating brush type; 500,000 ohms ±20%; ½ w; 11/16" lg x 1⅛" dia; IRC type Q.	Volume control.	3Z7498-50.182
	TERMINAL BOARD: connecting blocks; 18 solder lug term.; 5½" lg x 1½" wd x 13/16 h o/a; Jones HB Div part #110-J-15120.	Connecting block.	3Z770-18.15

7. Identification Table of Parts for Mast Base AB-15/GR

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	MAST BASE AB-15/GR: ceramic, rubber, and steel; holds ant. by insertion of ant. sect. in female portion of base, mts in 2½" dia hole in panel or plate; marked "AB-15/GR"; incl binding post on bottom for wire lead; Sig C dwg SC-D-12517.	Antenna mast base.	2A2081-15
	CAP, antenna base; dust cover f/mast base; 63/64" lg x 13/16" dia; Sig C dwg SC-D-19572.	Mast base cap.	2A387.4-4
P34	CONNECTOR, plug: Plug PL-259-A; 1 rd male cont; straight type; 1-21/32" lg x 11/16" OD 1 end, ½" OD other end; ANRFCCC dwg #RE49F167.	R-f connector.	2Z7226-259A
	GASKET: ins spacer; rubber; single hole; rd, 3" OD x 1-29/32" ID x 1/16" thk; Sig C dwg SC-D-12520-2.	Spacer.	2A1173.2-17
	INSULATOR, bowl: rd, corrugated; grade L2 ceramic, olive drab finish; 2-31/64" lg x 1½" ID x 1-31/32" OD w/2-¾" max dia; Sig C dwg SC-D-19572 and SC-D-12517.	Insulator support.	3G90-3
	INSULATOR, bowl: rd, corrugated; grade L2 ceramic, olive drab finish; 2¼" lg x 2" ID x 2¾-" OD w/3-1/16" max dia; Sig C dwg SC-D-12517-11.	Insulator support.	3G90-4
	INSULATOR, washer: rd, 11/16" OD x 7/16"ID x 3/64" thk; Sig C dwg SC-D-12520-3.	Spacer.	2A1173.2-16
	MOUNTING: socket for ant. sect.; 5⅞" lg x .395" dia; Sig C dwg SC-D-12517-1.	Antenna section socket.	2A281-30
	POST, binding: Binding Post TM-145; ¾" lg x 7/16" OD; Sig C dwg SC-D-530.	Binding post.	3Z245
	SUPPORT, antenna: steel; 4" lg x ¾" wd; Sig C dwg SC-D-12517-2.	Mast base body.	2A3393A.1-149
	SUPPORT, antenna: 5½" lg x 11/16" dia; Sig C dwg SC-D-21103.	Flexible antenna section.	2A3393A.1-148
	RING, bonding: 3⅛" OD x 2" ID x 1" thk o/a, w/slotted term. 15/16" lg x ¼" wd, bent at right angle; Sig C dwg SC-D-12517, group 25.	Bonding ring.	2Z7855-3
	WASHER, "C": C-shape; 7/16" ID x 11/16" OD x 3/64" thk w/⅛" opening; Sig C dwg SC-D-12520.	Spacer.	2A1173.2-18
	WASHER, flat: brass 7/16" screw size; 15/32" ID x ¾" OD x 1/16" thk.	Spacer.	6L50030-2
	WASHER, shouldered: rd w/beveled edge;; 1½" dia x ¼" thk w/29/64" hole; Sig C dwg SC-D-19572.	Bushing and spacer.	6L50530-6

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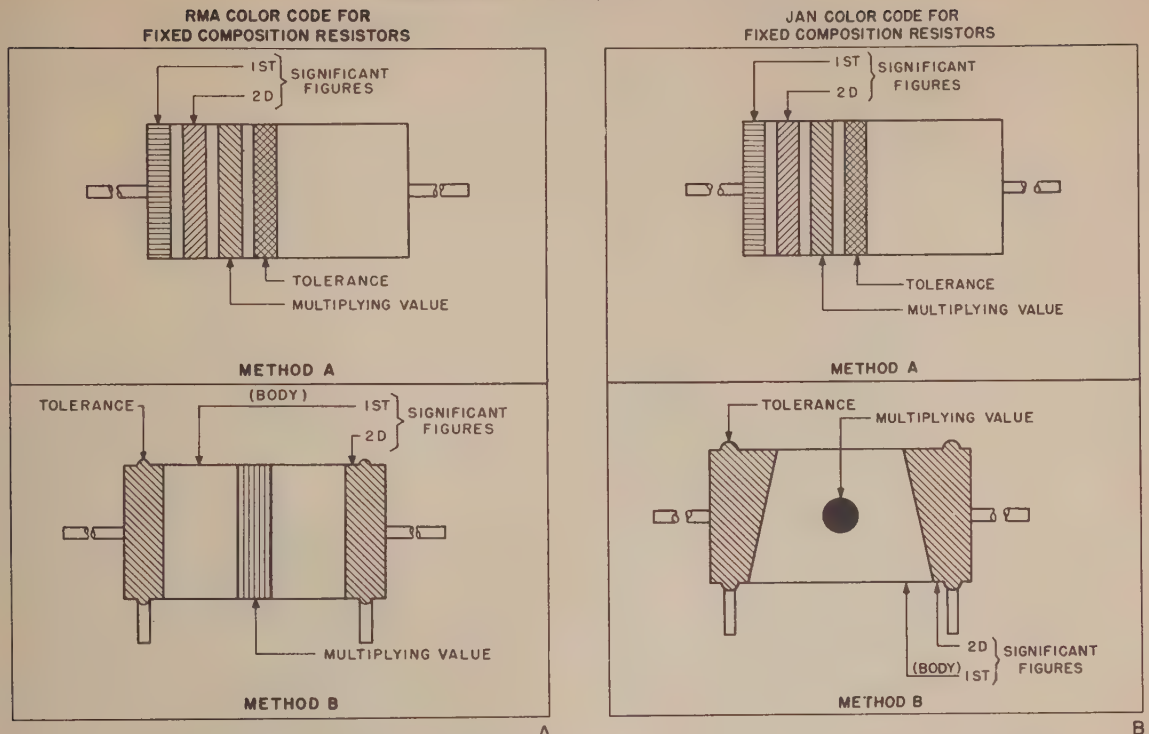
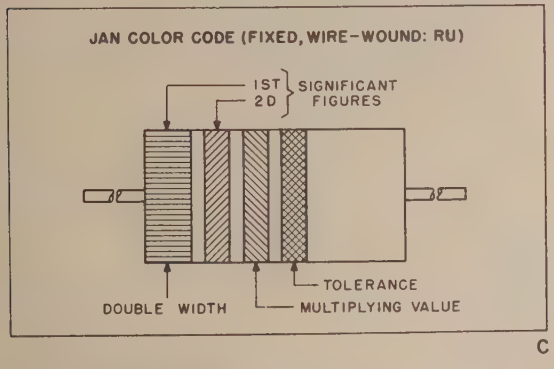
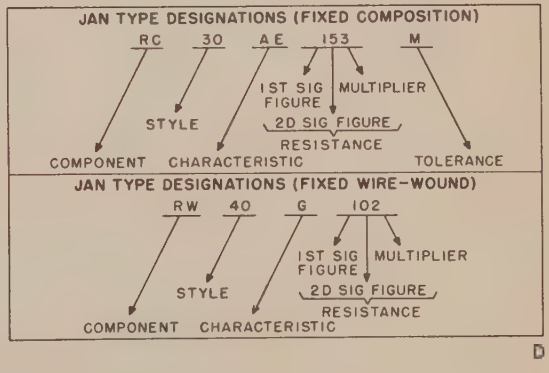
Spares	6, 9	4, 9
Speaker LS-158/U	7*e*	7
Squelch:		
Circuit	40*a*, *c*, 51	27, 34, 35
Maximum	85	66
Minimum	84	66
Stopping procedure	20	17
Switch:		
Guard	6	4
Meter	18*a*, *b*, 47*c*, 78*a-e*, 79*b-h*	13, 31, 63, 64, 65
Microphone	19*b*, 72	17, 56
T		
Test, operational	64*b*, 69	48, 50
Test equipment	66	49
Testing, final	80	66
Trouble-shooting:		
Field and depot level	64, 73	48, 62
Organizational level	34, 39	23, 24
Tool, alignment, TL-207	79*e*	64, 65
Transconductance	56*c*	39, 40
Transmitter alinement	79	64, 65
Trimmer, antenna	39*b*	24
Trimmers, adjustment of	78*c*	64
U		
Unpacking	13	10
V		
Vibrator	7*a*, 19*c*, 53	3, 35, 37
Voltage measurements	79	64, 65
Volume control	61, 18*c*, 19*a*	44, 17
Volume control, automatic	46*b*	30
W		
Weak signals	36*e*, 38	24, 25

RESISTOR COLOR AND LETTER CODE







STANDARDS				
COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)	JAN LETTER TOLERANCE
BLACK	0	1	—	—
BROWN	1	10	± 1	F
RED	2	100	± 2	G
ORANGE	3	1,000	± 3	—
YELLOW	4	10,000	± 4	—
GREEN	5	100,000	± 5	—
BLUE	6	1,000,000	± 6	—
VIOLET	7	10,000,000	± 7	—
GRAY	8	100,000,000	± 8	—
WHITE	9	1,000,000,000	± ■	—
GOLD	—	0.1	± ■	J
SILVER	—	0.01	±10	K
NO COLOR	—	—	±20	M

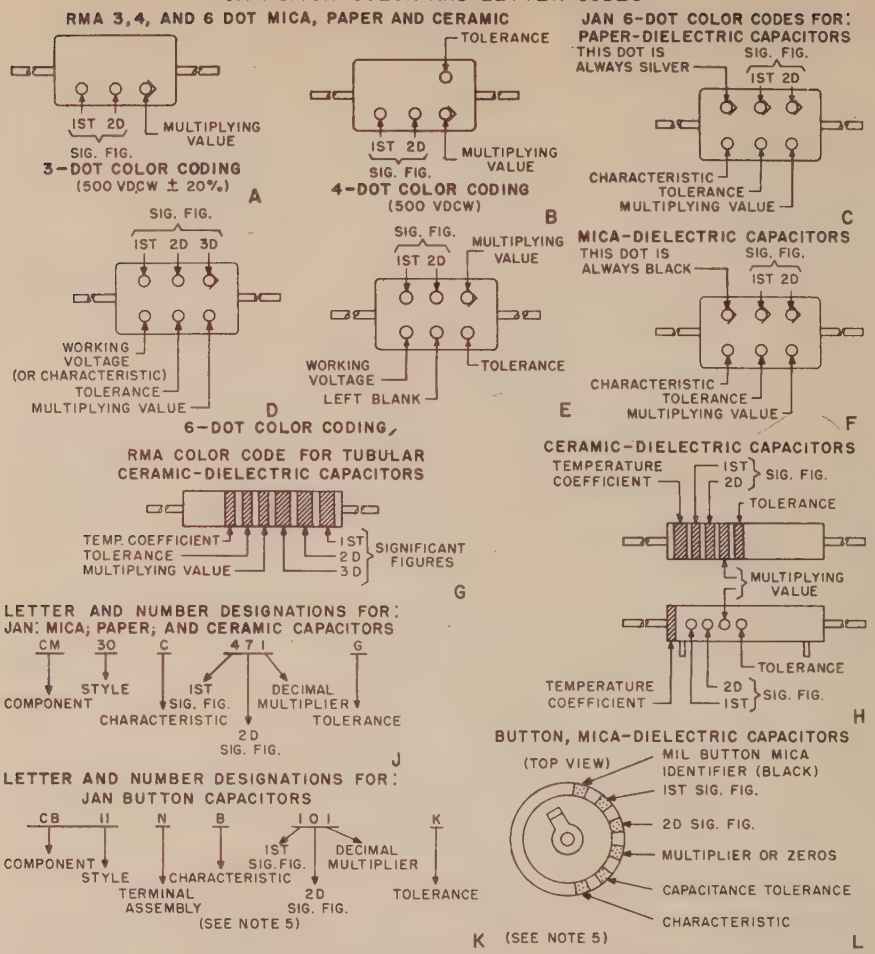
NOTES:

1. RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.
2. RMA: RADIO MANUFACTURERS ASSOCIATION.
3. JAN: JOINT ARMY-NAVY.
4. THESE COLOR AND NUMBER CODES GIVE ALL RESISTANCE VALUES IN OHMS.
5. RESISTIVE COMPONENTS USED FOR LETTER TOLERANCES ARE: RC, RN, AND RU.
6. WATTAGE FOR RW TYPES IS FOUND IN THE JAN SPECIFICATIONS UNDER CHARACTERISTICS.

TM RC

Figure 72. Resistor color codes.

CAPACITOR COLOR AND LETTER CODES



- STANDARDS -					JAN MICA-CM		JAN PAPER-CN		JAN CERAMIC-CC					
										CAP. TOL. FOR MORE THAN 10 UUF		CAP. TOL. FOR 10 UUF OR LESS		
COLOR	SIG. FIG.	DECIMAL MULTIPLIER	% TOL.	VDCW	LETTER TOL.	CHARAC-TERISTIC	LETTER TOL.	CHARAC-TERISTIC	DEC. MULT.	%	LETTER DESIG-NATION	UUF	LETTER DESIG-NATION	CHARAC-TERISTIC
BLACK	0	1	±20	500	M	A	M	A	1	±20	M	±2.0	G	C
BROWN	1	10	± 1	100	-	B	-	E	10	± 1	F	-	-	H
RED	2	100	± 2	200	G	C	-	H	100	± 2	G	-	-	L
ORANGE	3	1,000	± 3	300	-	D	N*	J	1,000	-	-	-	-	P
YELLOW	4	10,000	± 4	400	-	E	-	P	-	-	-	-	-	R
GREEN	5	100,000	± 5	500	-	F	-	R	-	± 5	J	±0.5	D	S
BLUE	6	1,000,000	± 6	600	-	G	-	S	-	-	-	-	-	T
VIOLET	7	10,000,000	± 7	700	-	-	-	T	-	-	-	-	-	U
GRAY	8	100,000,000	± 8	800	-	-	-	-	0.01	-	-	±0.25	C	B
WHITE	9	1,000,000,000	± 9	900	-	-	-	-	0.1	± 10	K	±1.0	F	SL
GOLD	-	0.1	± 5	1,000	J	-	-	-	-	-	-	-	-	A
SILVER	-	0.01	±10	2,000	K	-	K	-	-	-	-	-	-	-
NO COLOR	-		±20	500	-	-	-	-	-	-	-	-	-	-

* THE TOLERANCE OF THIS CAPACITOR IS ±30%, NOT ±2%

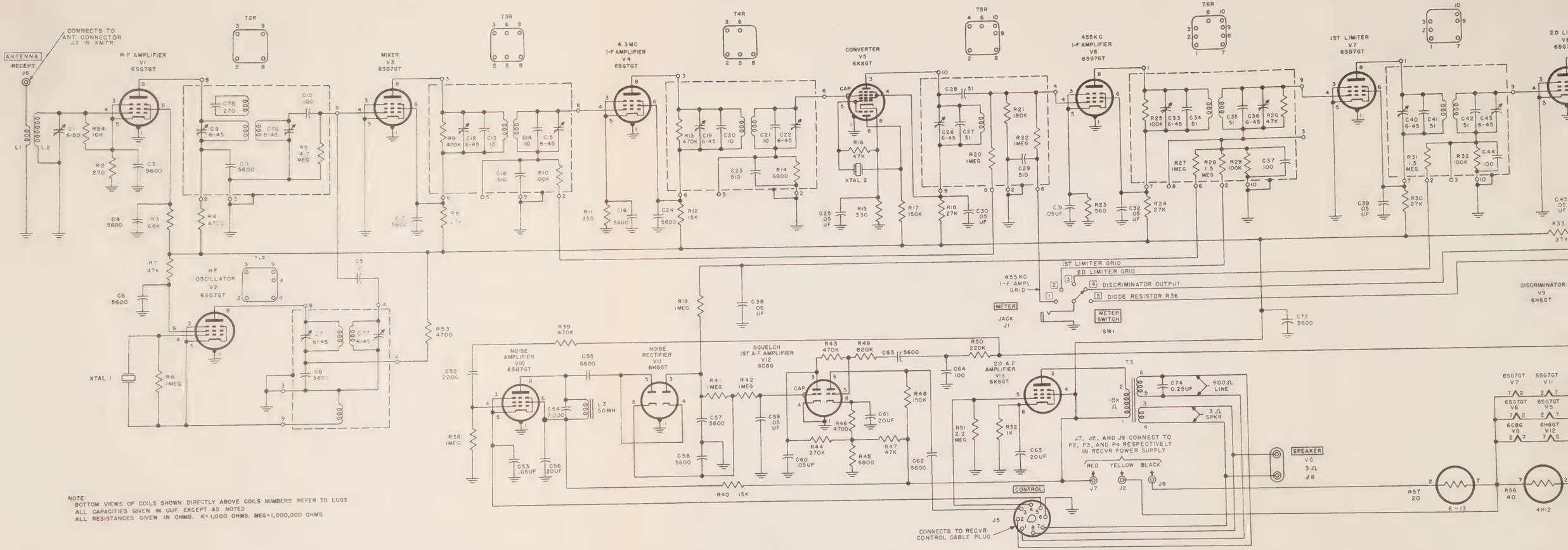
NOTES

JAN: JOINT ARMY-NAVY
RMA: RADIO MANUFACTURERS ASSOCIATION

1. THESE COLOR AND LETTER CODES GIVE CAPACITANCES IN MICROMICROFARADS
2. THIS TABLE IS ADAPTED FOR JAN AND RMA COLOR AND JAN LETTER TYPE DESIGNATIONS
3. CERAMIC AND MICA CAPACITORS, BOTH JAN AND RMA, ARE GENERALLY 500 VDCW
4. BUTTON CAPACITORS ARE GENERALLY 300 VDCW
5. READ BUTTON CAPACITOR TOLERANCE UNDER CERAMICS OF MORE THAN 10 UUF
6. CHARACTERISTICS ARE AVAILABLE IN JAN CAPACITOR SPECIFICATION MANUALS
7. THE COMPONENTS USED ABOVE FOR JAN LETTER TYPE DESIGNATIONS ARE:
   CB MICA BUTTON; *CC* CERAMIC; *CM* MICA MOULDED; *CN* PAPER MOULDED

TM CC

Figure 73. Capacitor color codes.



NOTE:
BOTTOM VIEWS OF COILS SHOWN DIRECTLY ABOVE COILS NUMBERS REFER TO LUGS
ALL CAPACITIES GIVEN IN UUF EXCEPT AS NOTED
ALL RESISTANCES GIVEN IN OHMS. K=1,000 OHMS. MEG=1,000,000 OHMS

Figure 74. Radio Receiver R-435 VRC-2X, over-all schematic.

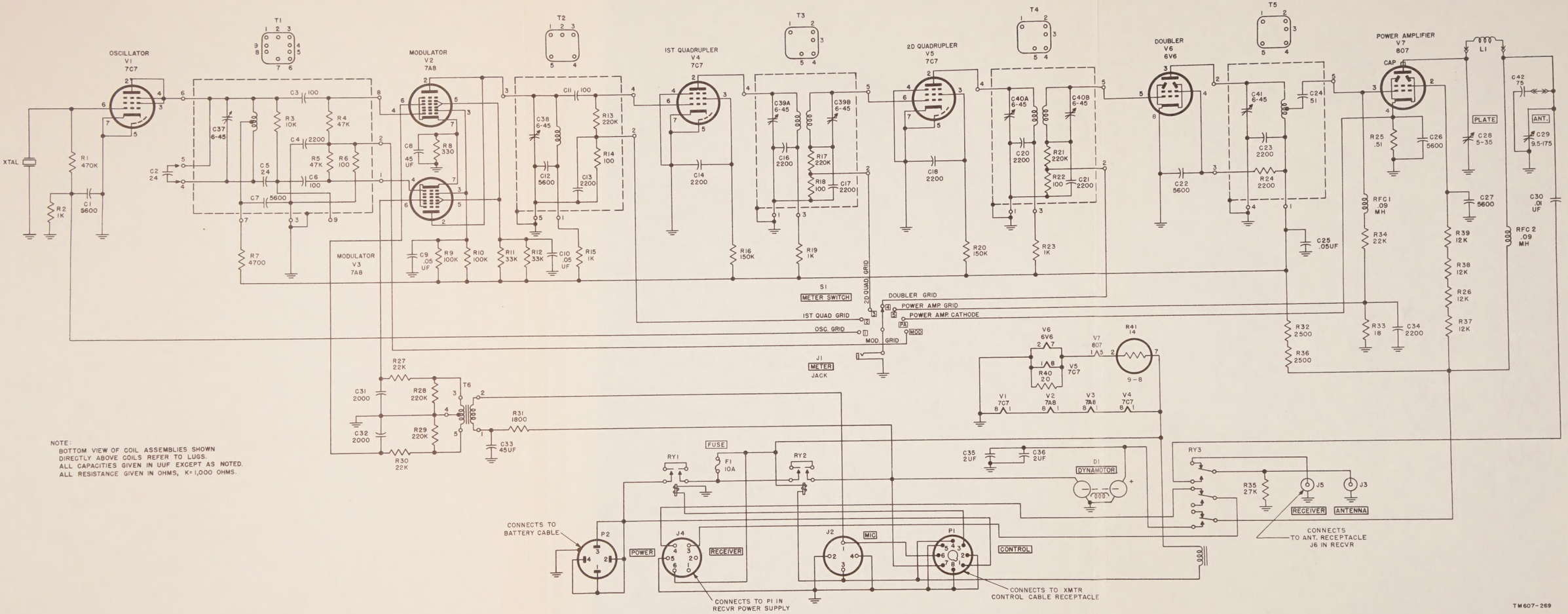
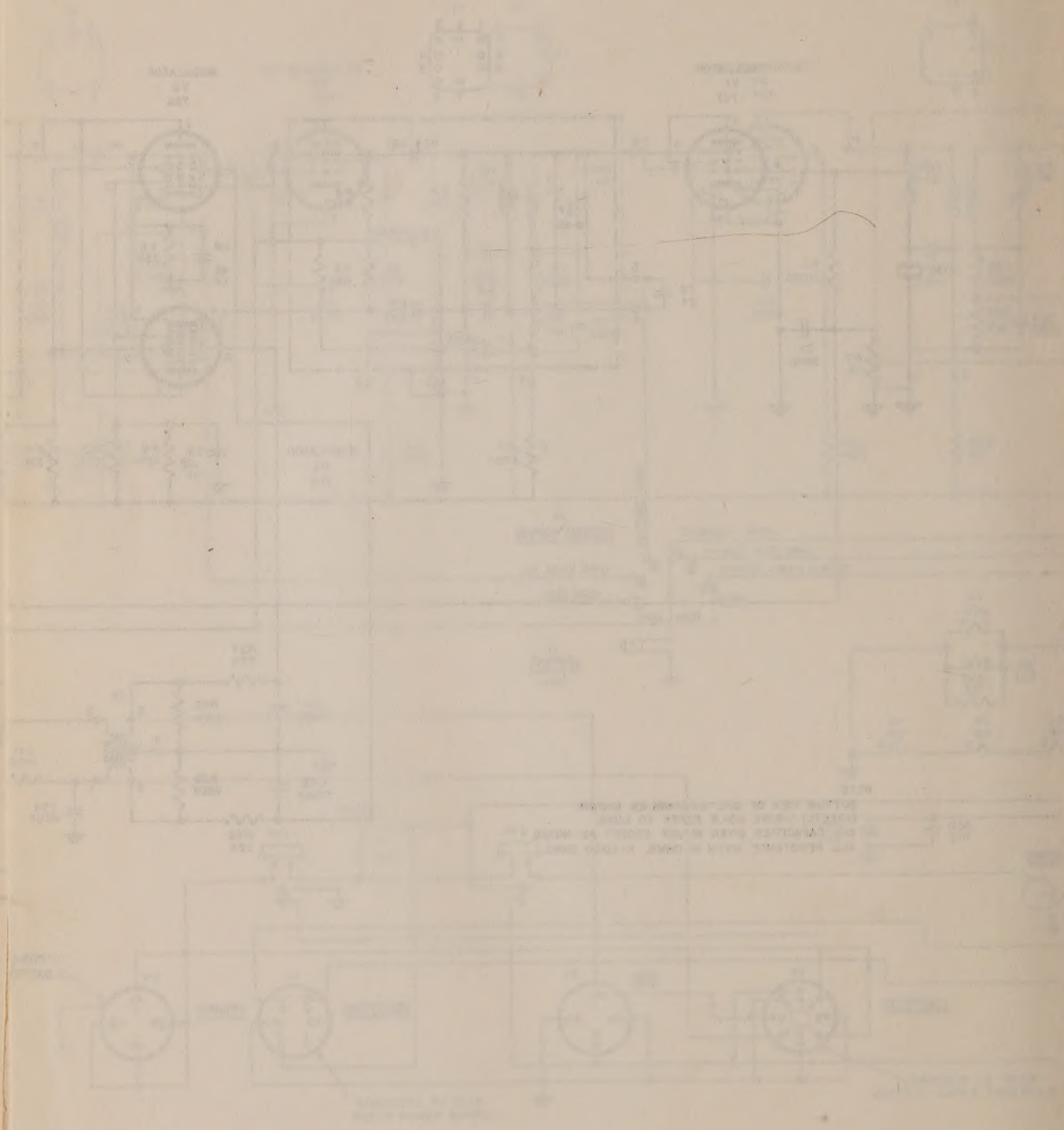
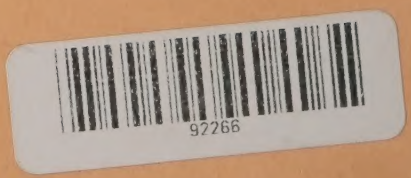


Figure 75. Radio Transmitter T-322 VRC-2X, over-all schematic.

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